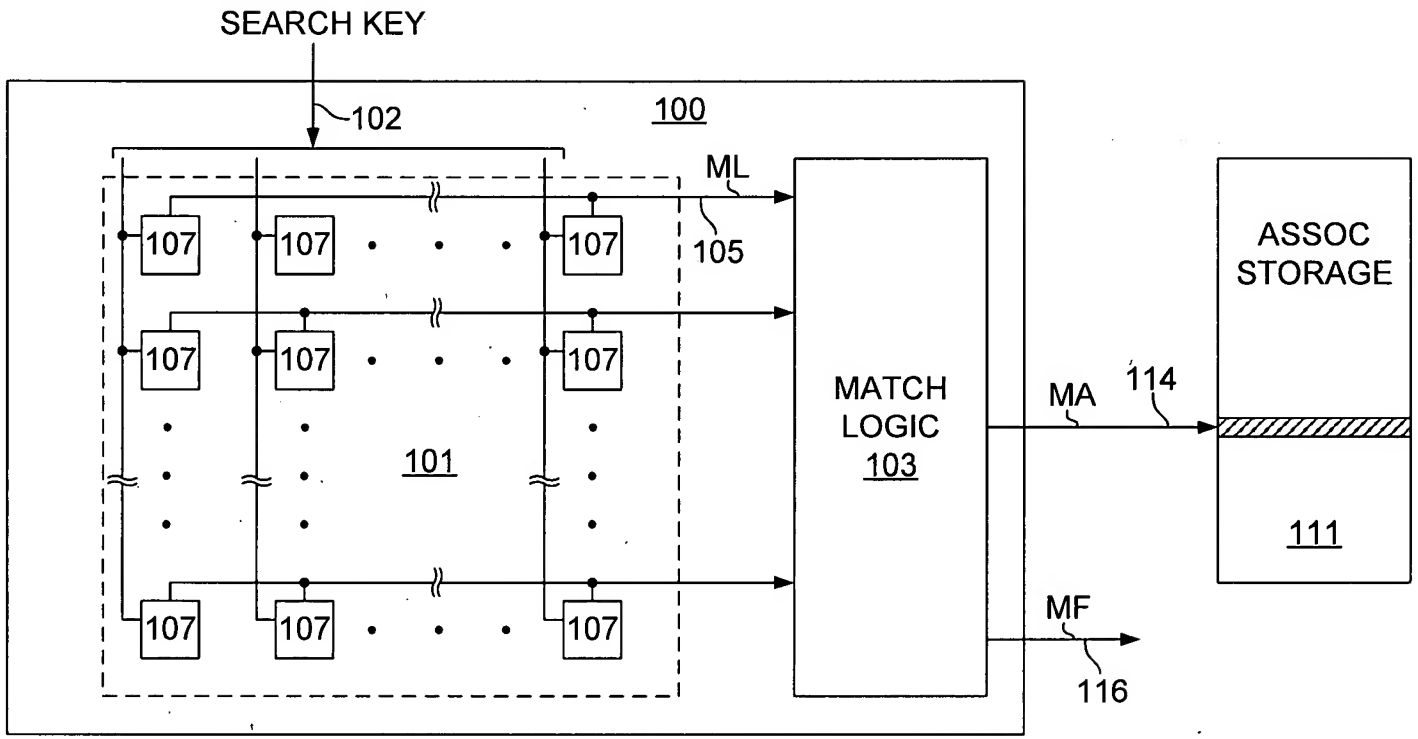


FIG. 1
(Prior Art)

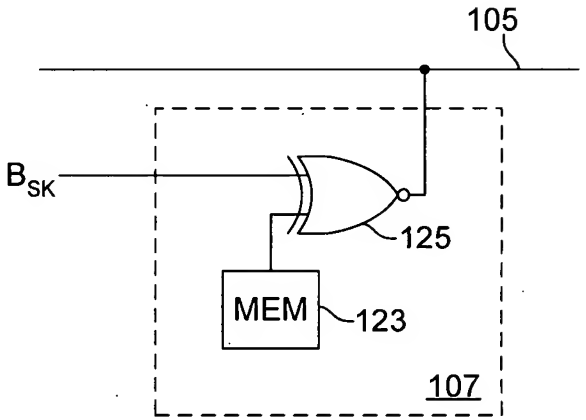


FIG. 2
(Prior Art)

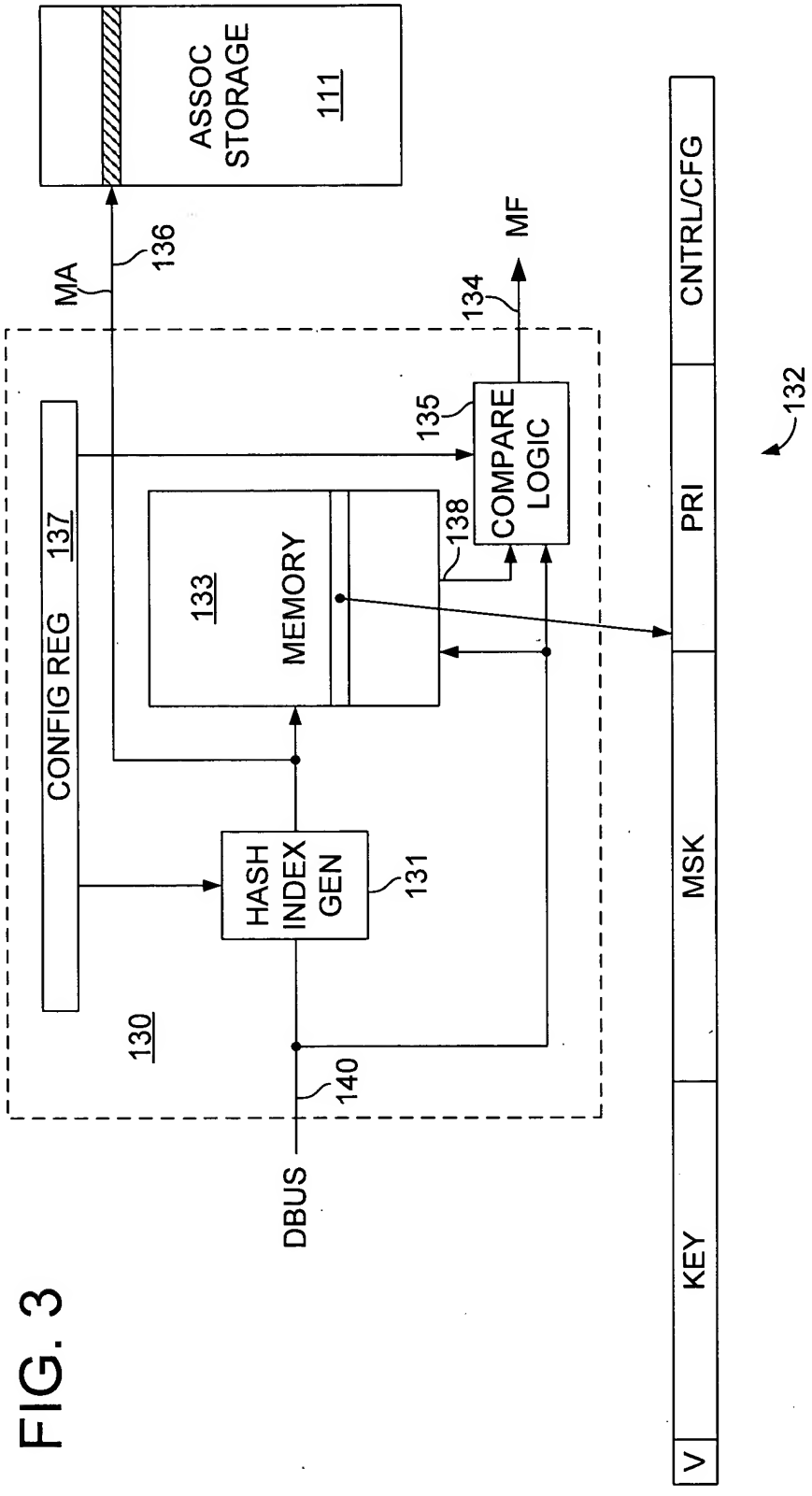

ASSOC STORAGE
111
MA
136
MF
134
CONFIG REG
137
135
COMPARE LOGIC
133
MEMORY
138
HASH INDEX GEN
131
130
140
DBUS
V
KEY
MSK
PRI
CNTRL/CFG
132

FIG. 3

FIG. 4

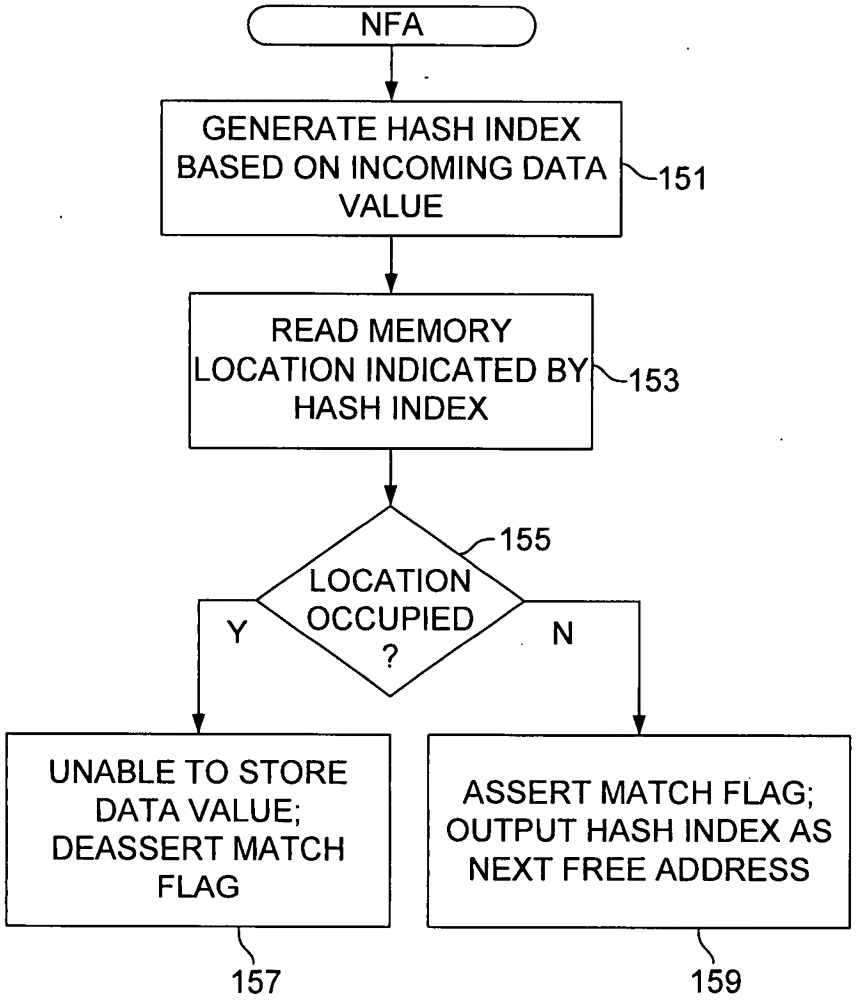
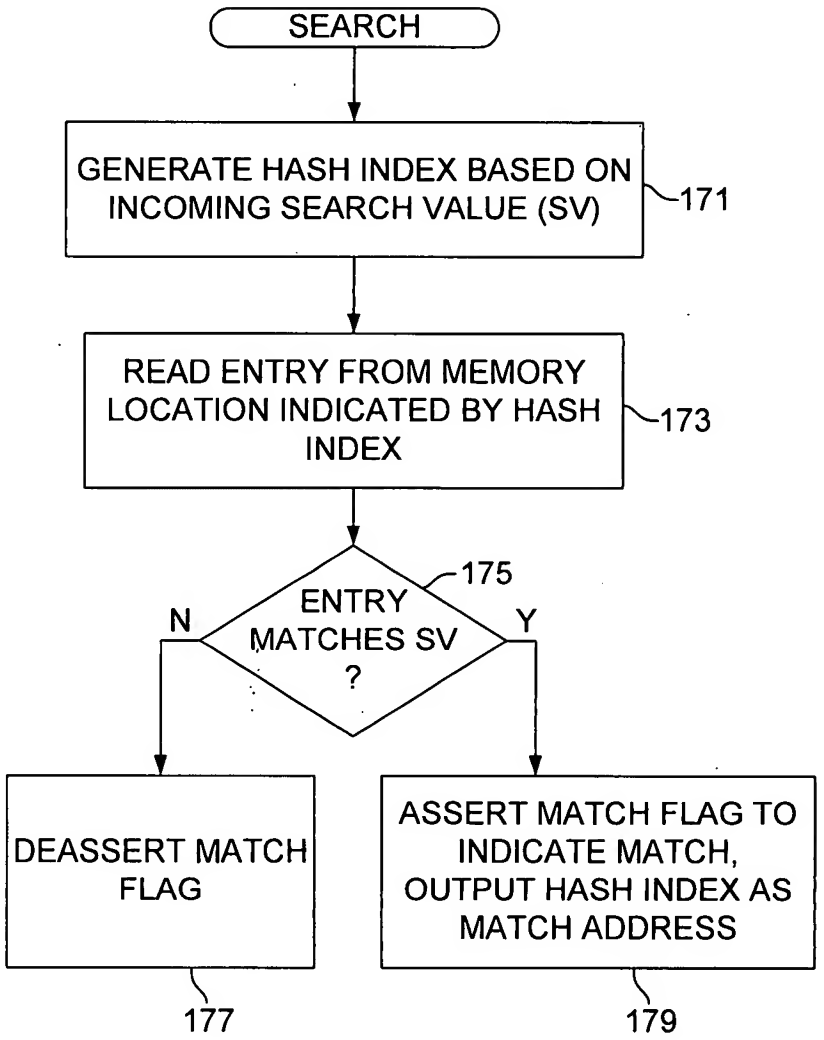

NFA
GENERATE HASH INDEX BASED ON INCOMING DATA VALUE
151
READ MEMORY LOCATION INDICATED BY HASH INDEX
153
LOCATION OCCUPIED ?
155
Y
N
UNABLE TO STORE DATA VALUE; DEASSERT MATCH FLAG
157
ASSERT MATCH FLAG; OUTPUT HASH INDEX AS NEXT FREE ADDRESS
159

FIG. 5


SEARCH
GENERATE HASH INDEX BASED ON INCOMING SEARCH VALUE (SV)
171
READ ENTRY FROM MEMORY LOCATION INDICATED BY HASH INDEX
173
ENTRY MATCHES SV ?
175
N
Y
DEASSERT MATCH FLAG
177
ASSERT MATCH FLAG TO INDICATE MATCH, OUTPUT HASH INDEX AS MATCH ADDRESS
179

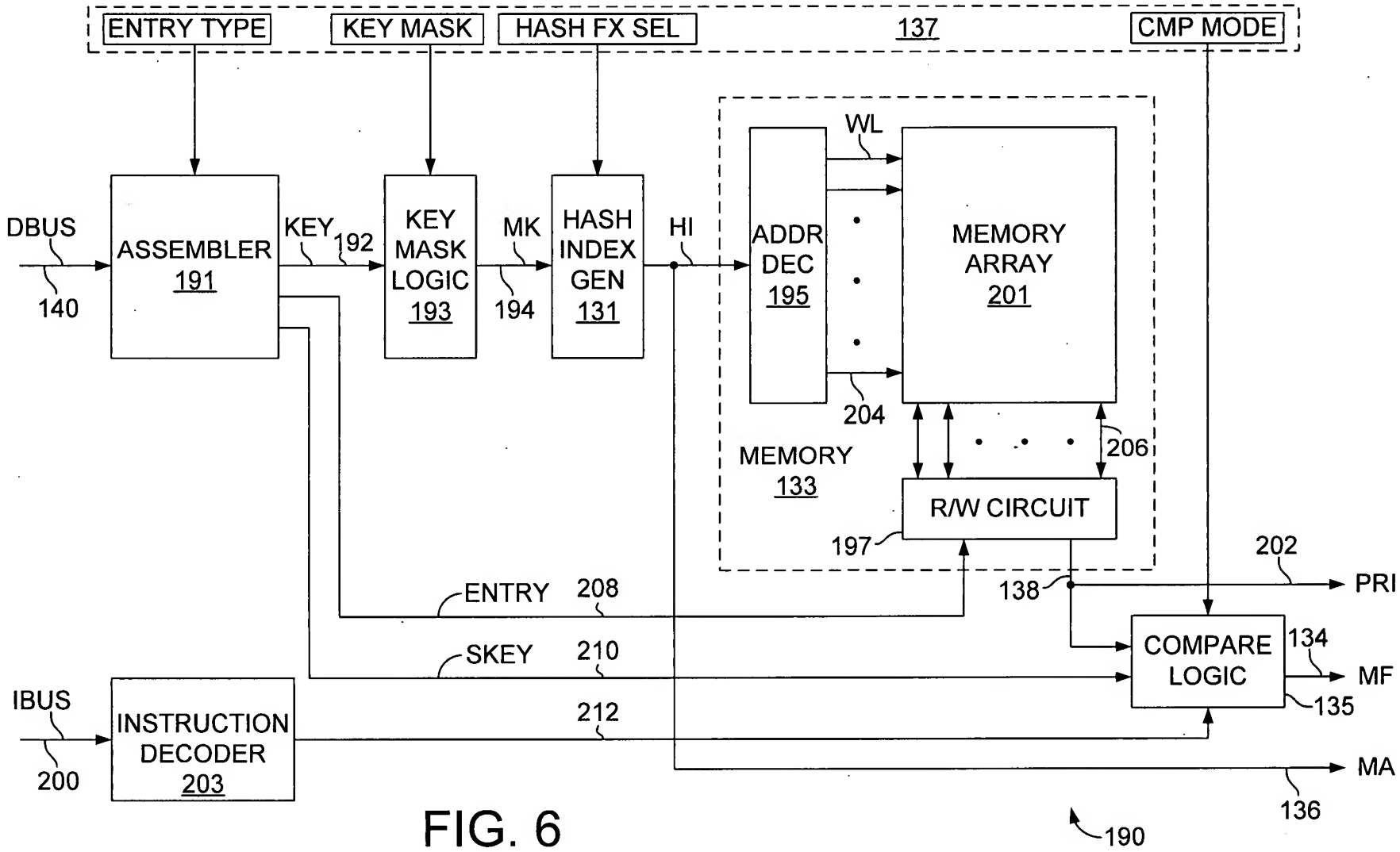

ENTRY TYPE
KEY MASK
HASH FX SEL
137
CMP MODE
DBUS
140
ASSEMBLER
191
KEY
192
KEY MASK LOGIC
193
MK
194
HASH INDEX GEN
131
HI
WL
ADDR DEC
195
MEMORY ARRAY
201
204
206
MEMORY
133
R/W CIRCUIT
197
202
PRI
138
ENTRY
208
SKEY
210
212
COMPARE LOGIC
134
MF
135
IBUS
200
INSTRUCTION DECODER
203
MA
136
190

FIG. 6

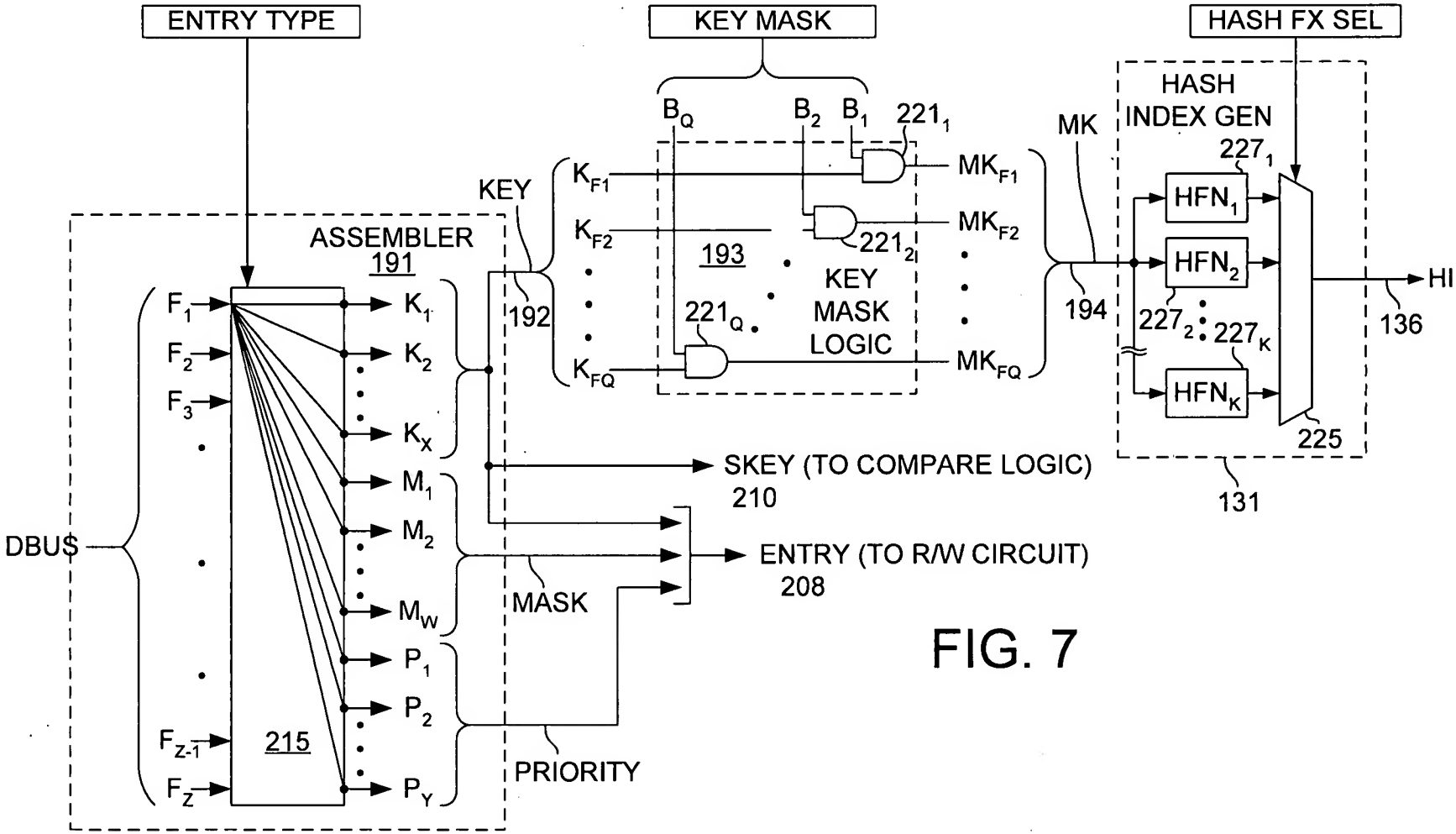

ENTRY TYPE
KEY MASK
HASH FX SEL
HASH INDEX GEN
ASSEMBLER 191
KEY
MK
HI
136
192
193
194
131
210
208
225
215
MASK
PRIORITY
DBUS
SKEY (TO COMPARE LOGIC)
ENTRY (TO R/W CIRCUIT)
KEY MASK LOGIC
F1
F2
F3
FZ-1
FZ
K1
K2
KX
M1
M2
MW
P1
P2
PY
KF1
KF2
KFQ
MKF1
MKF2
MKFQ
BQ
B2
B1
2211
2212
221Q
2271
2272
227K
HFN1
HFN2
HFNK

FIG. 7

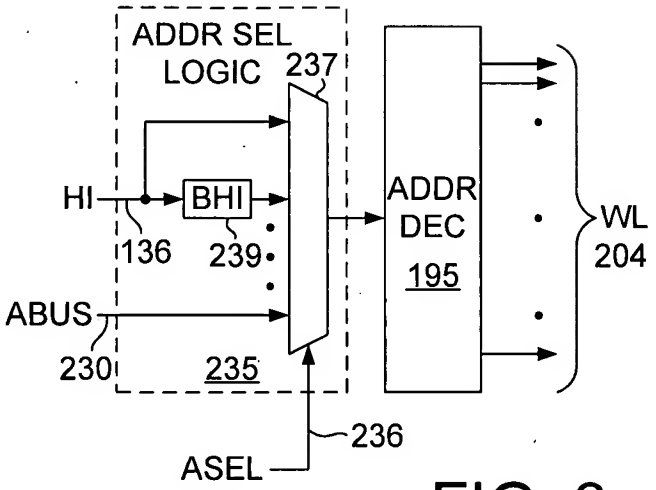


FIG. 8

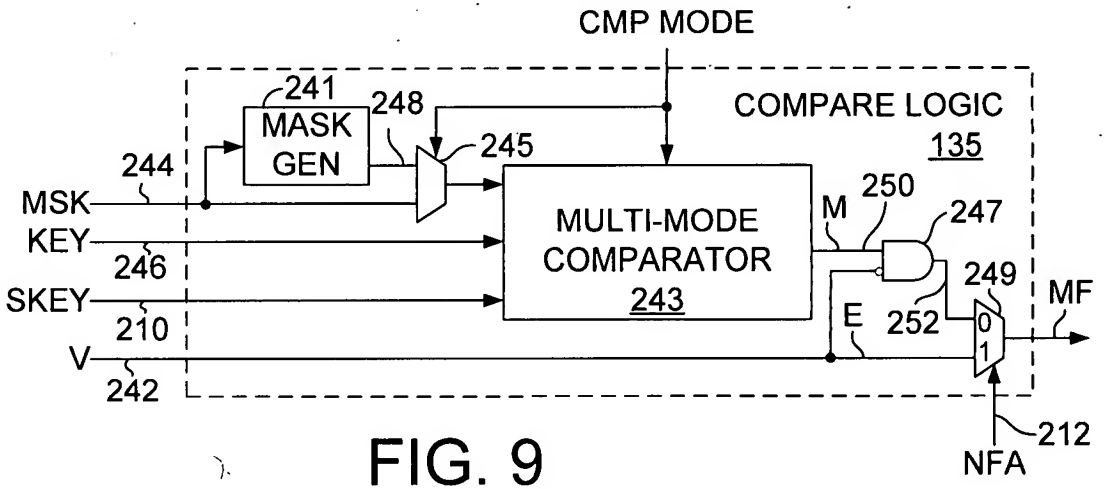


FIG. 9

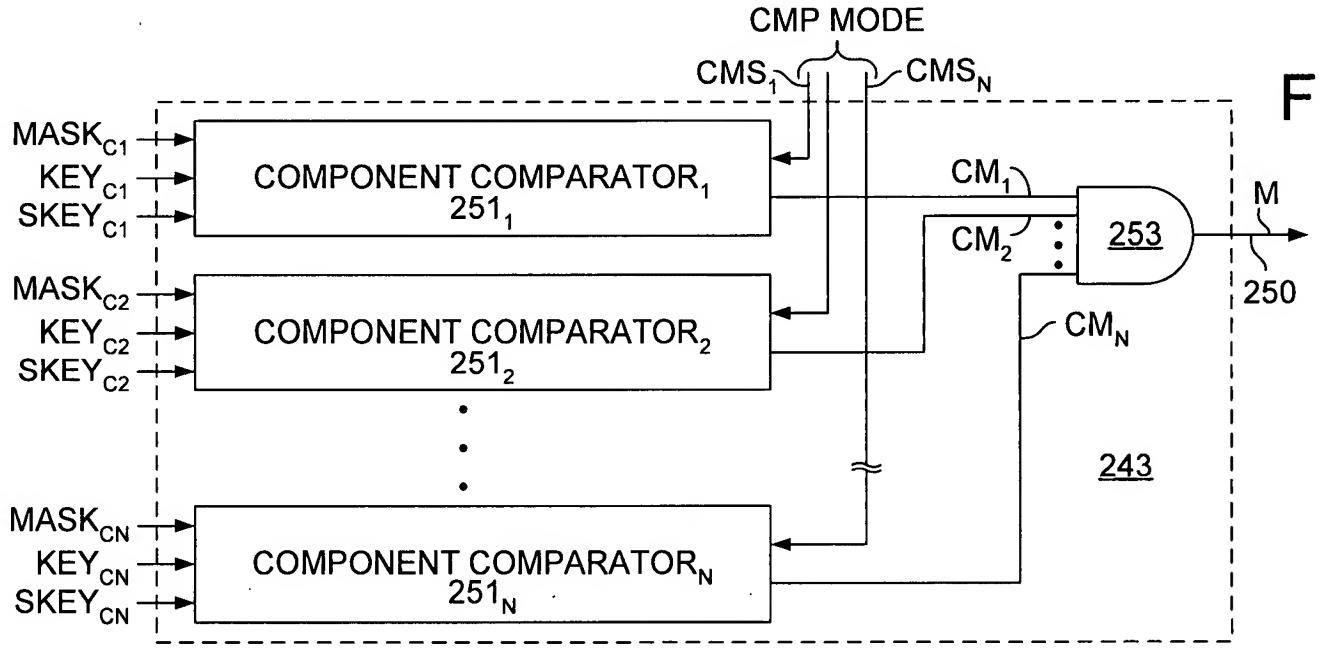


FIG. 10

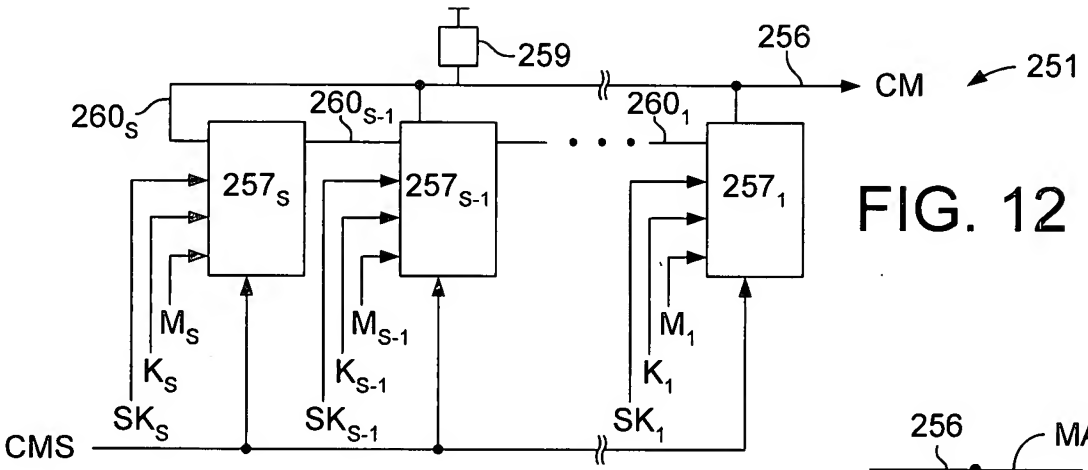


FIG. 12

FIG. 11

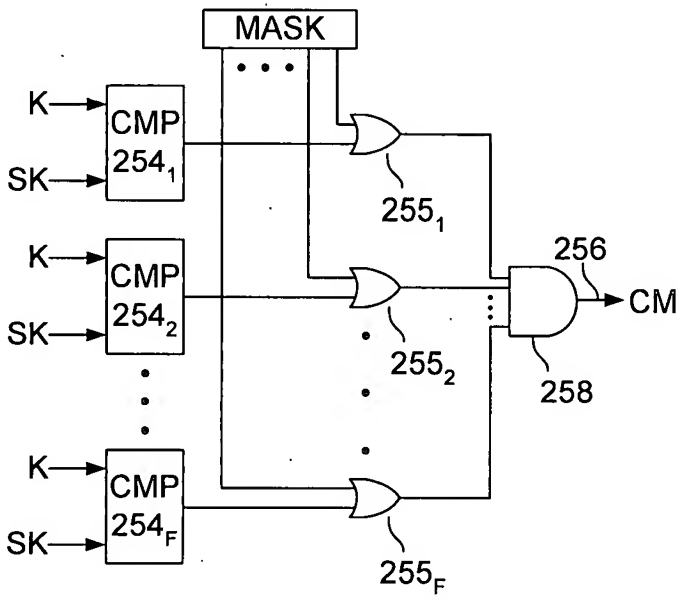
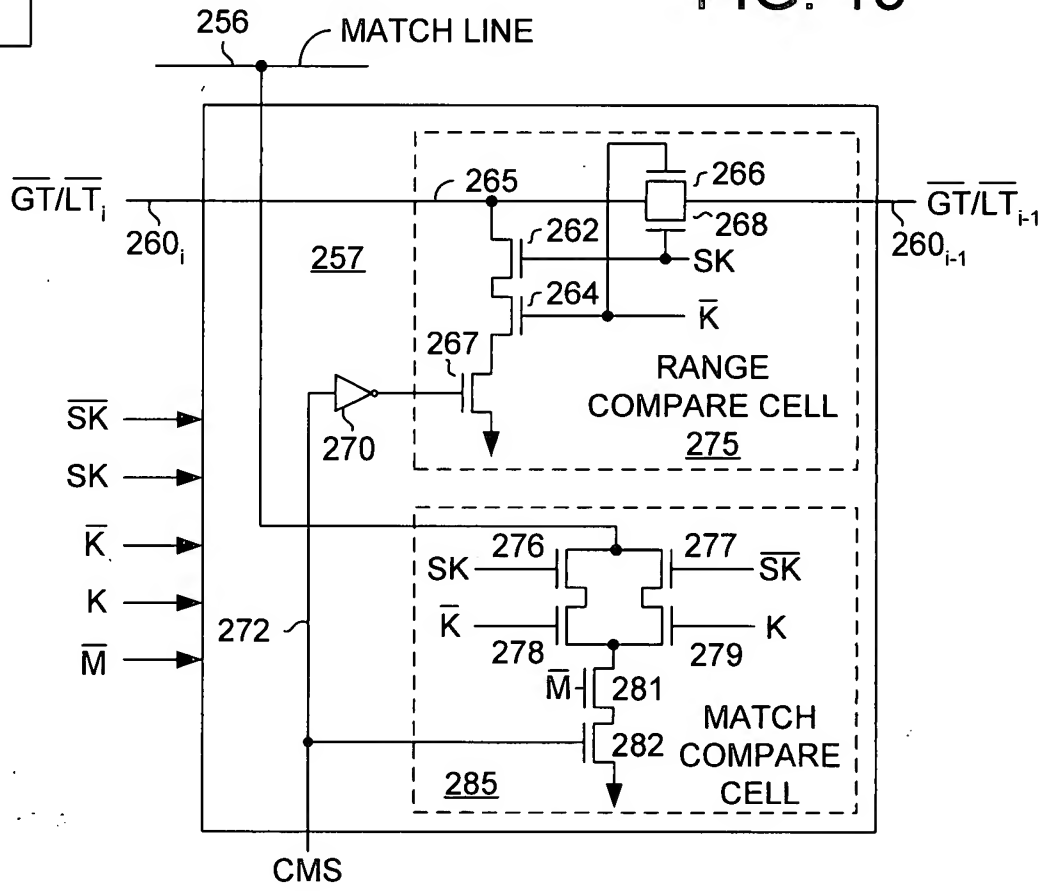


FIG. 13



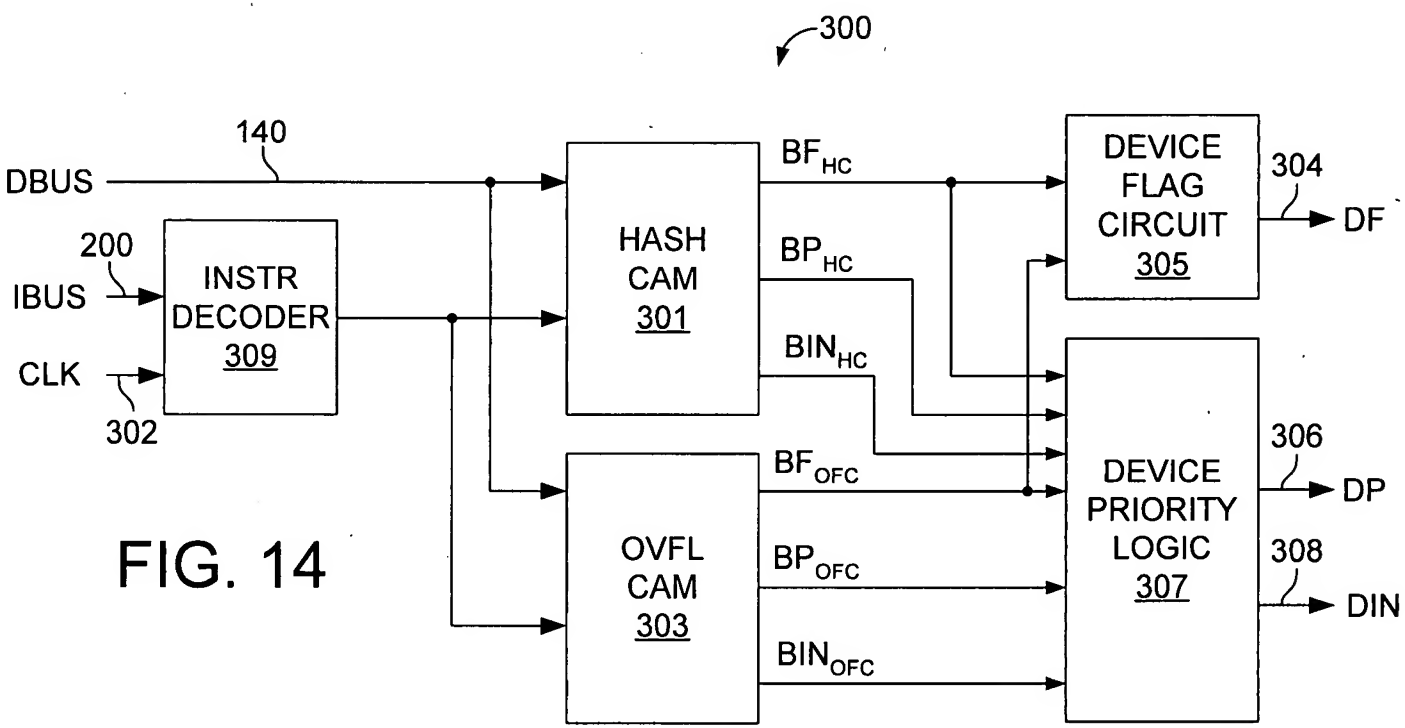

300
140
DBUS
200
IBUS
CLK
302
INSTR DECODER 309
HASH CAM 301
OVFL CAM 303
BF_HC
BP_HC
BIN_HC
BF_OFC
BP_OFC
BIN_OFC
DEVICE FLAG CIRCUIT 305
304
DF
DEVICE PRIORITY LOGIC 307
306
DP
308
DIN

FIG. 14

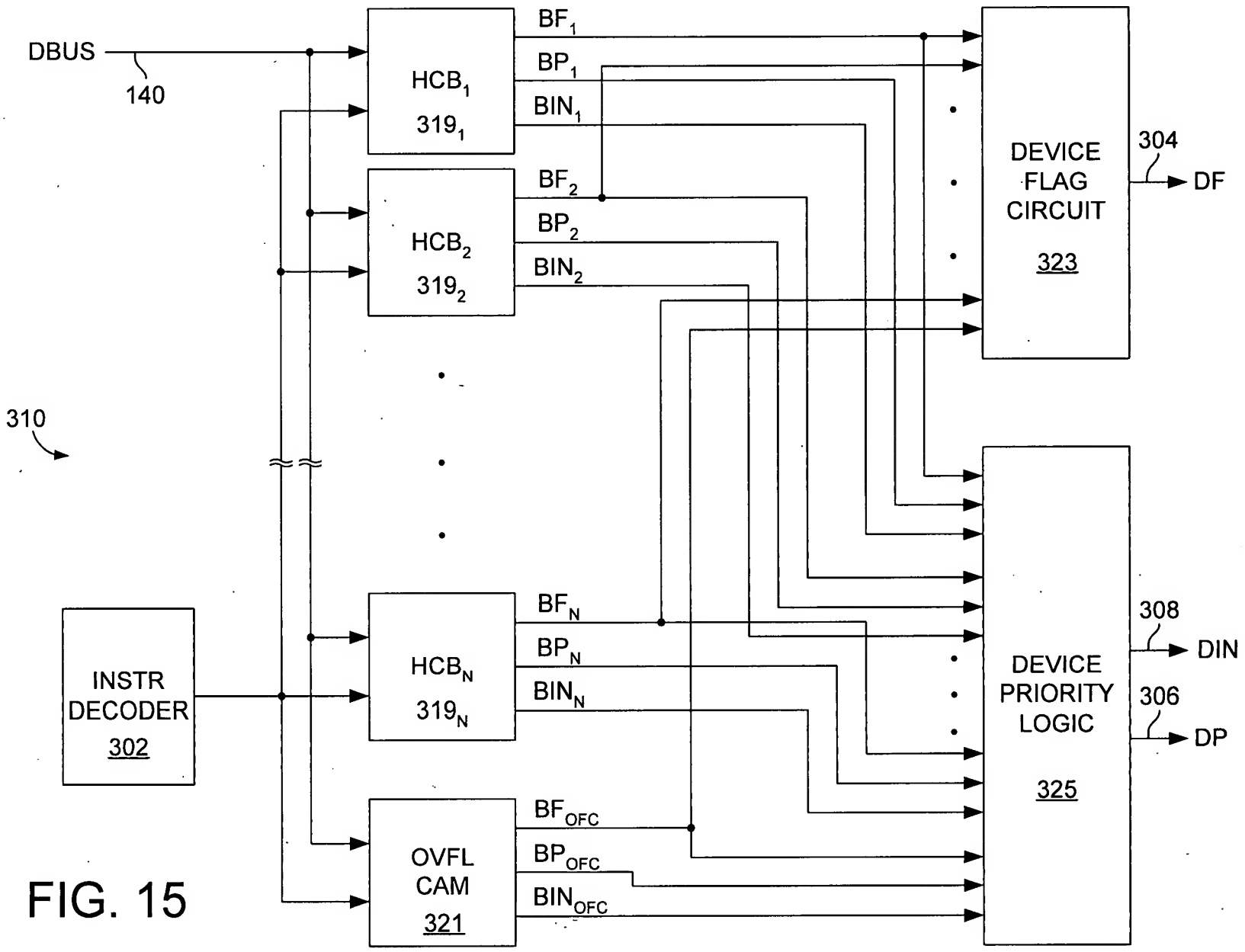

DBUS
140
HCB1
3191
HCB2
3192
HCBN
319N
OVFL
CAM
321
INSTR
DECODER
302
310
BF1
BP1
BIN1
BF2
BP2
BIN2
BFN
BPN
BINN
BFOFC
BPOFC
BINOFC
DEVICE
FLAG
CIRCUIT
323
304
DF
DEVICE
PRIORITY
LOGIC
325
308
DIN
306
DP

FIG. 15

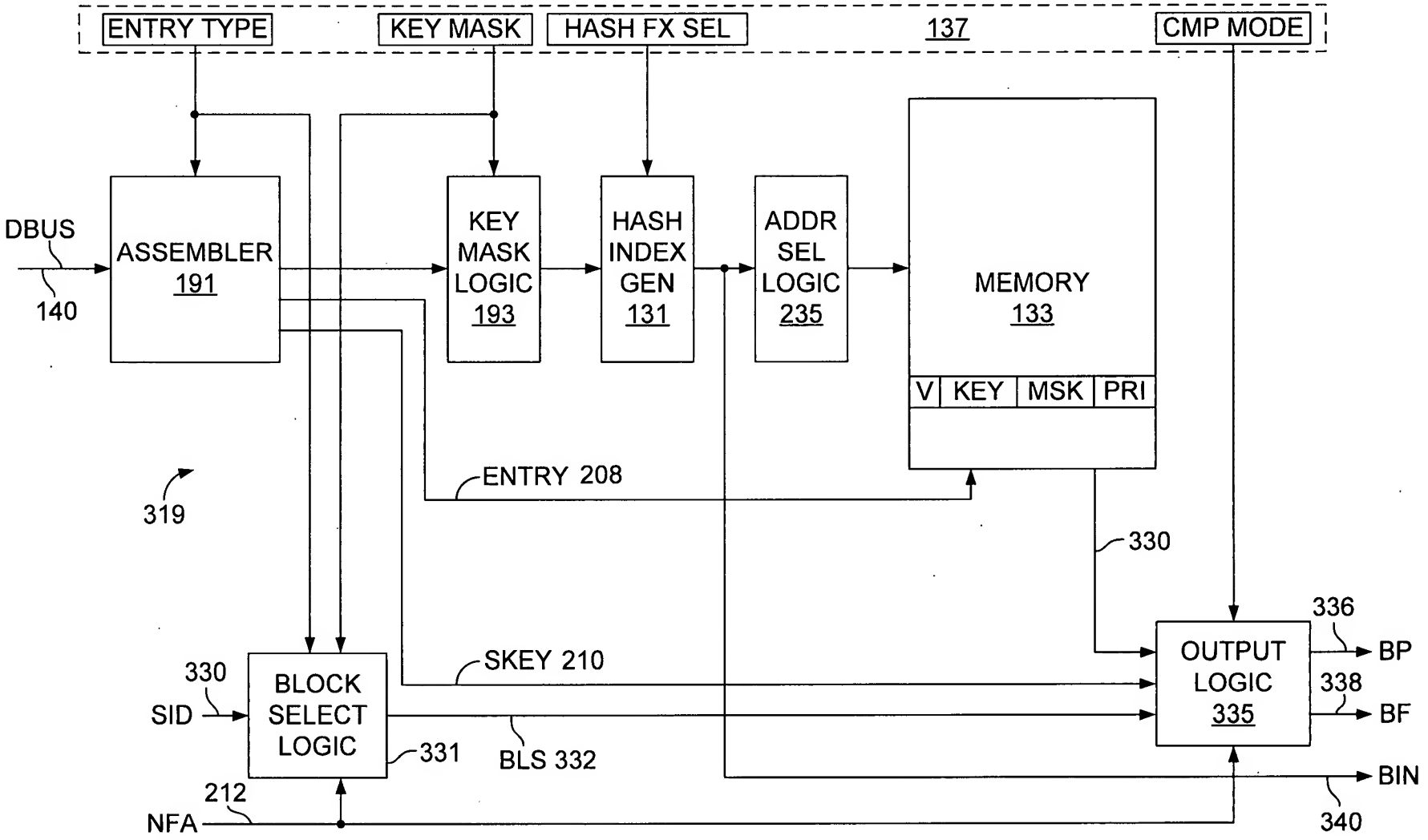

ENTRY TYPE
KEY MASK
HASH FX SEL
137
CMP MODE
DBUS
140
ASSEMBLER
191
KEY
MASK
LOGIC
193
HASH
INDEX
GEN
131
ADDR
SEL
LOGIC
235
MEMORY
133
V
KEY
MSK
PRI
319
ENTRY 208
330
336
OUTPUT
LOGIC
335
BP
338
BF
BIN
340
330
SID
BLOCK
SELECT
LOGIC
331
SKEY 210
BLS 332
212
NFA

FIG. 16

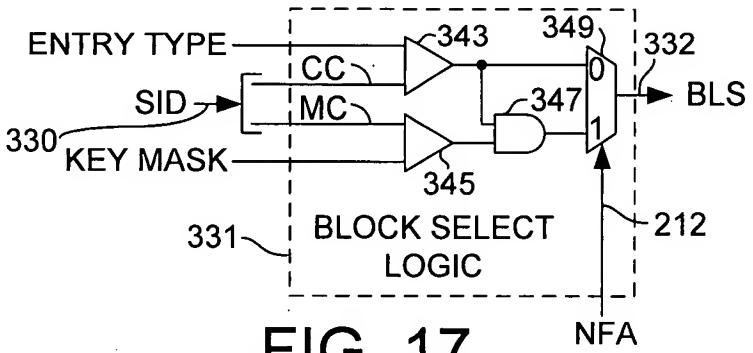


FIG. 17

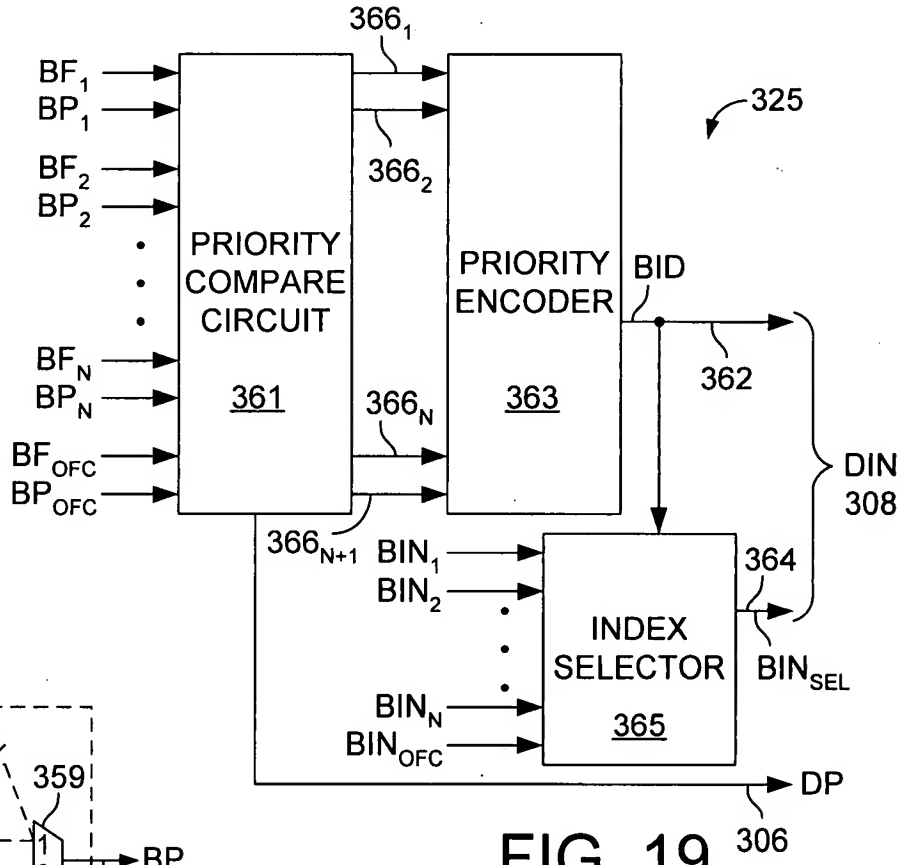
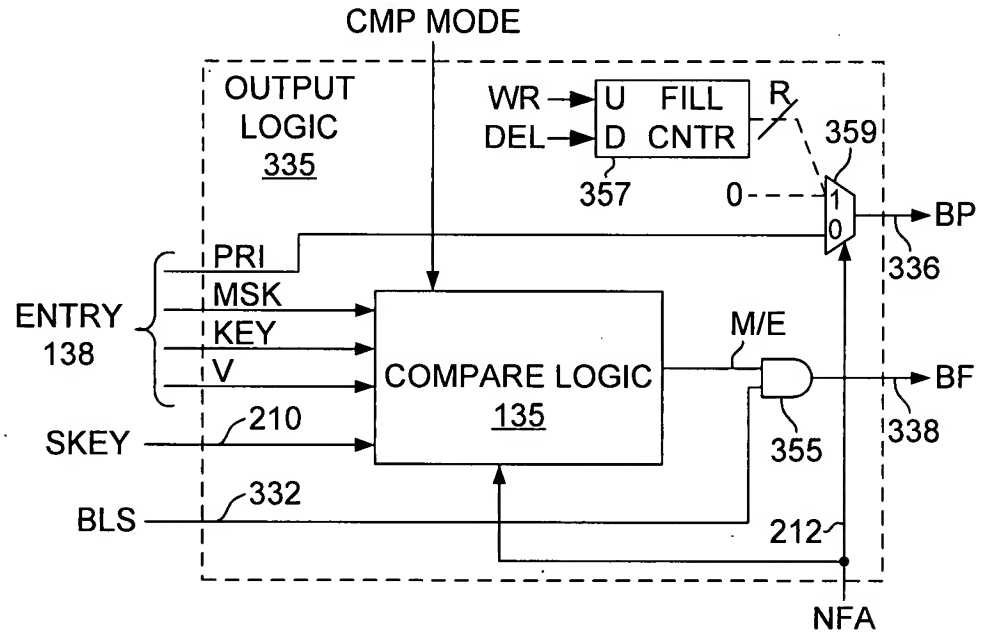


FIG. 18

FIG. 19



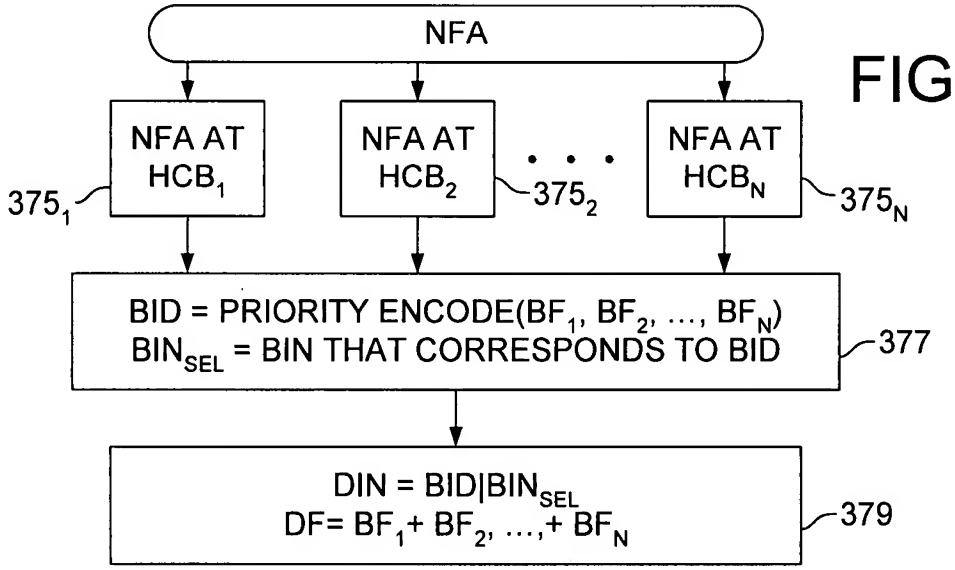


FIG. 20

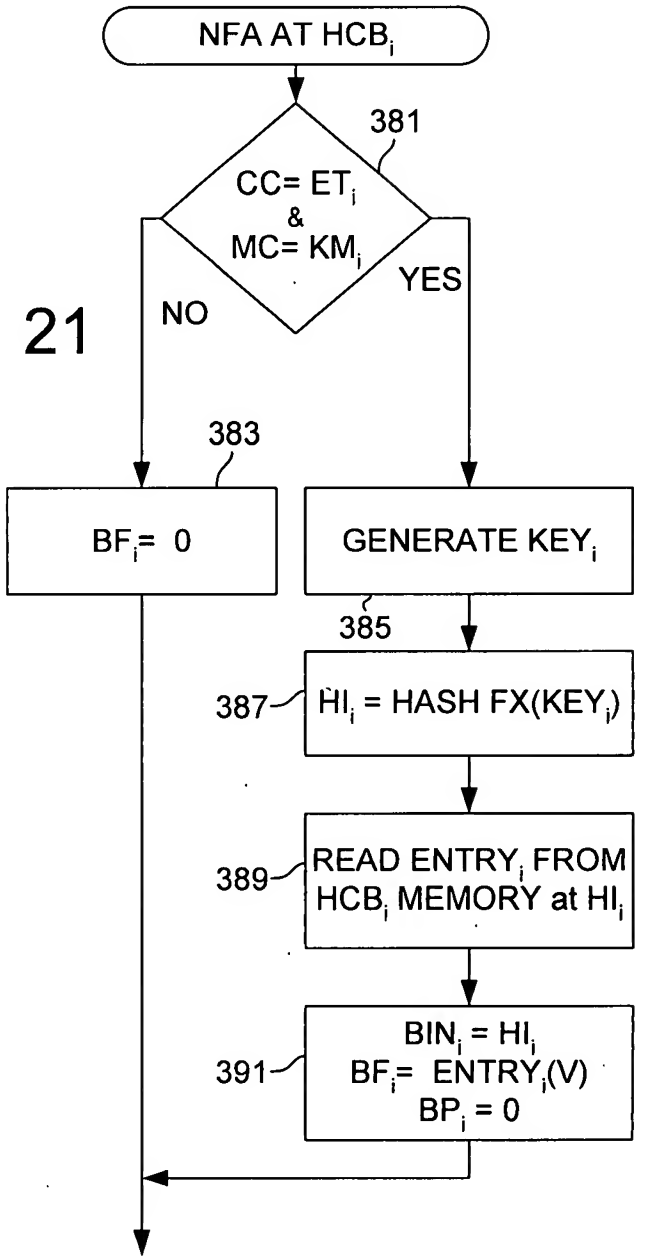


FIG. 21

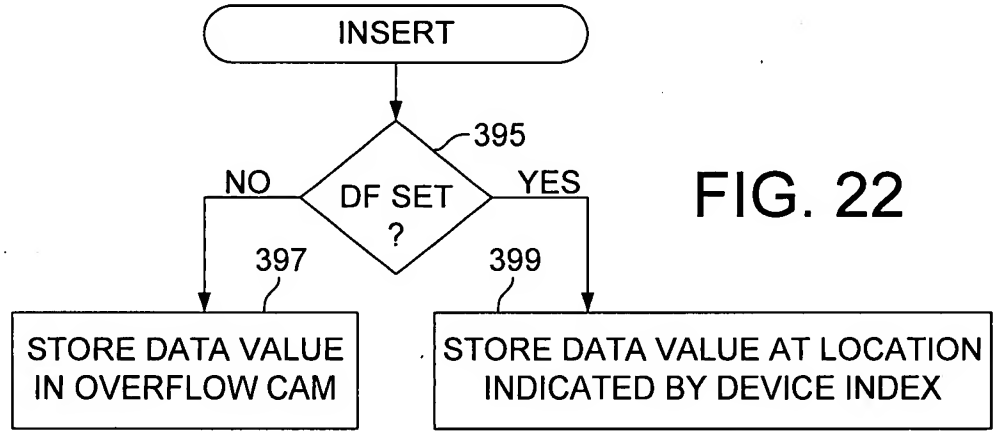


FIG. 22

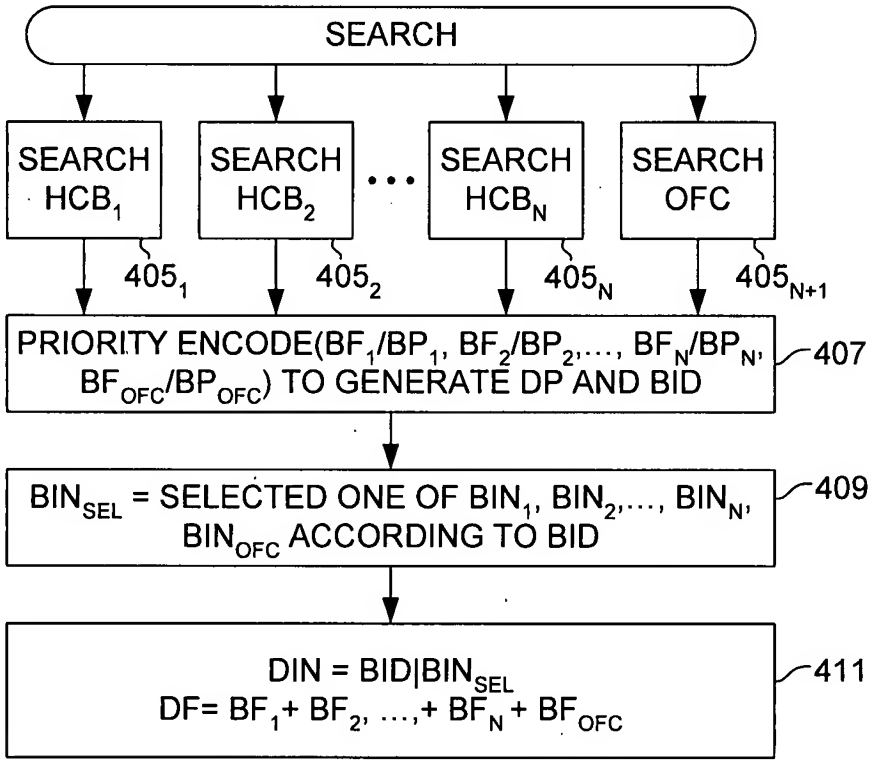

SEARCH
SEARCH HCB1
SEARCH HCB2
SEARCH HCBN
SEARCH OFC
405_1
405_2
405_N
405_N+1
PRIORITY ENCODE(BF1/BP1, BF2/BP2,..., BFN/BPN, BFOFC/BPOFC) TO GENERATE DP AND BID
407
BINSEL = SELECTED ONE OF BIN1, BIN2,..., BINN, BINOFC ACCORDING TO BID
409
DIN = BID|BINSEL
DF= BF1+ BF2, ...,+ BFN + BFOFC
411

FIG. 23

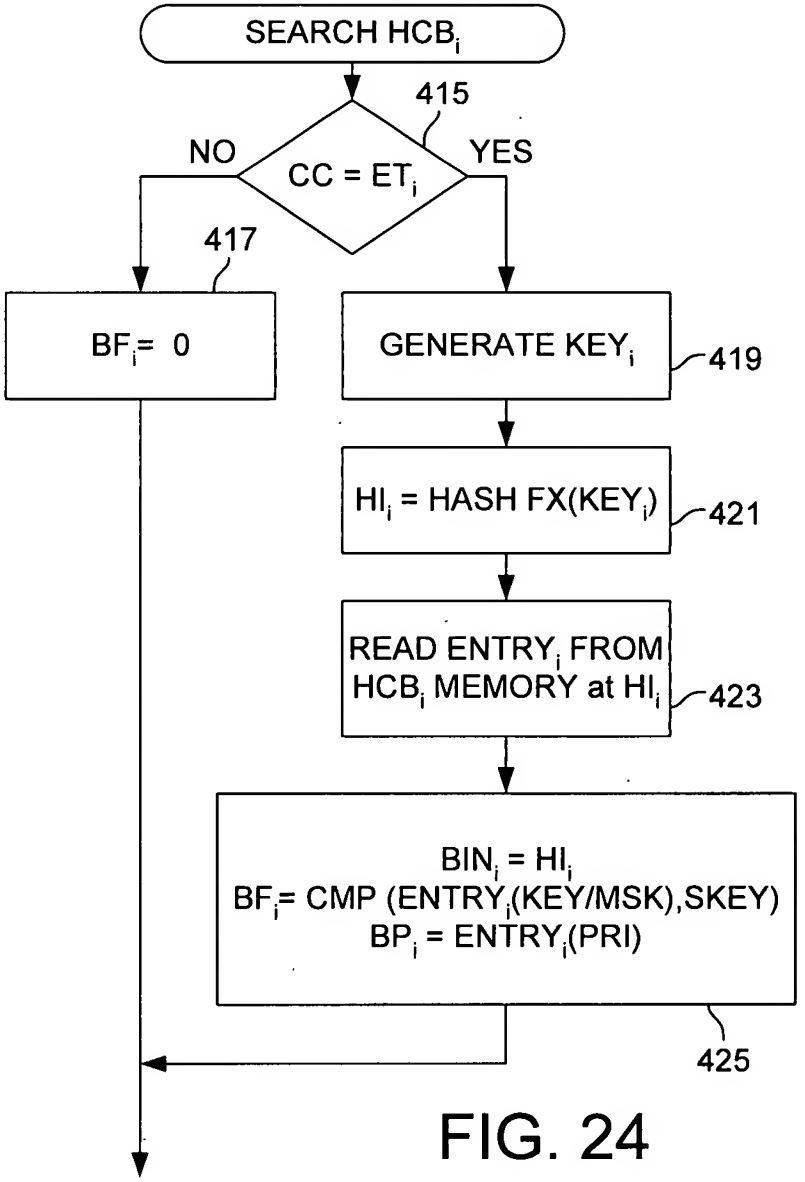

SEARCH HCBi
415
NO
CC = ETi
YES
417
BFi= 0
GENERATE KEYi
419
HIi = HASH FX(KEYi)
421
READ ENTRYi FROM HCBi MEMORY at HIi
423
BINi = HIi
BFi= CMP (ENTRYi(KEY/MSK),SKEY)
BPi = ENTRYi(PRI)
425

FIG. 24

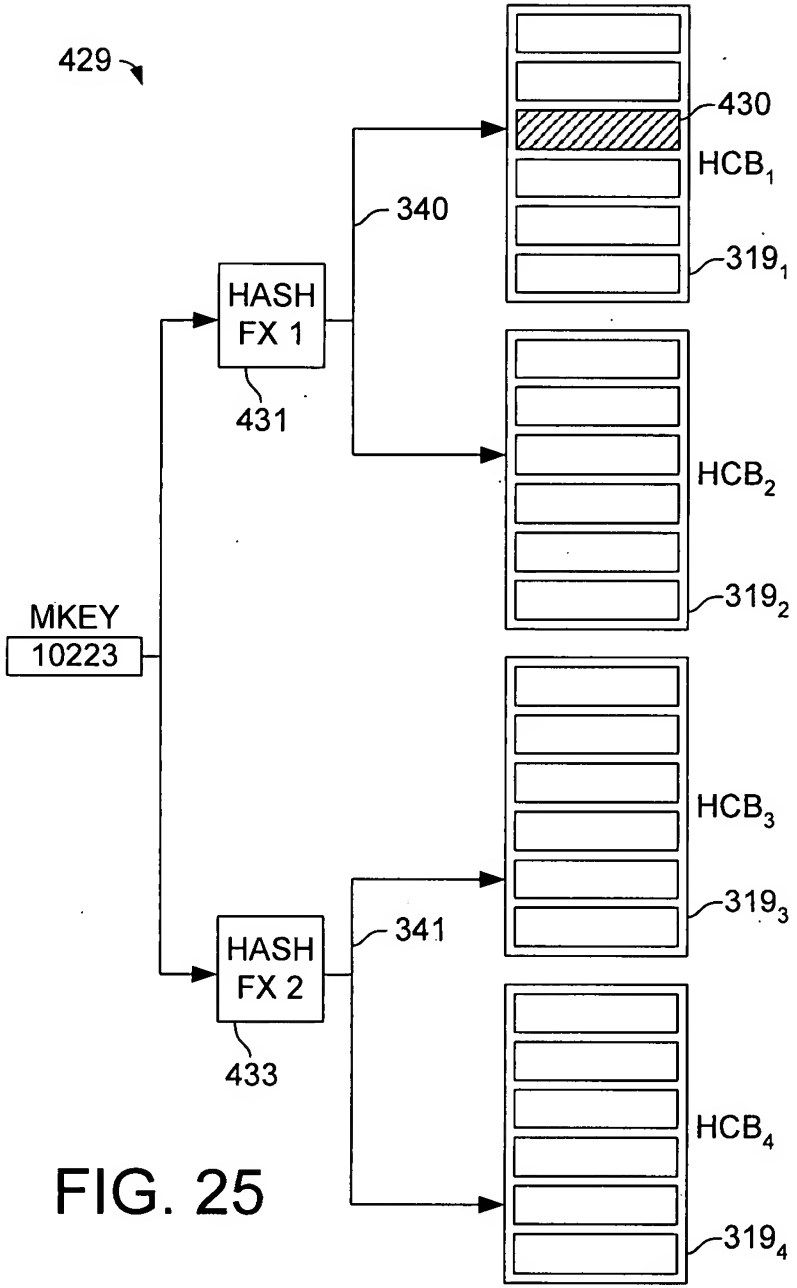

429
430
HCB1
340
319 1
HASH
FX 1
431
HCB2
319 2
MKEY
10223
HCB3
319 3
HASH
FX 2
341
433
HCB4
319 4

FIG. 25

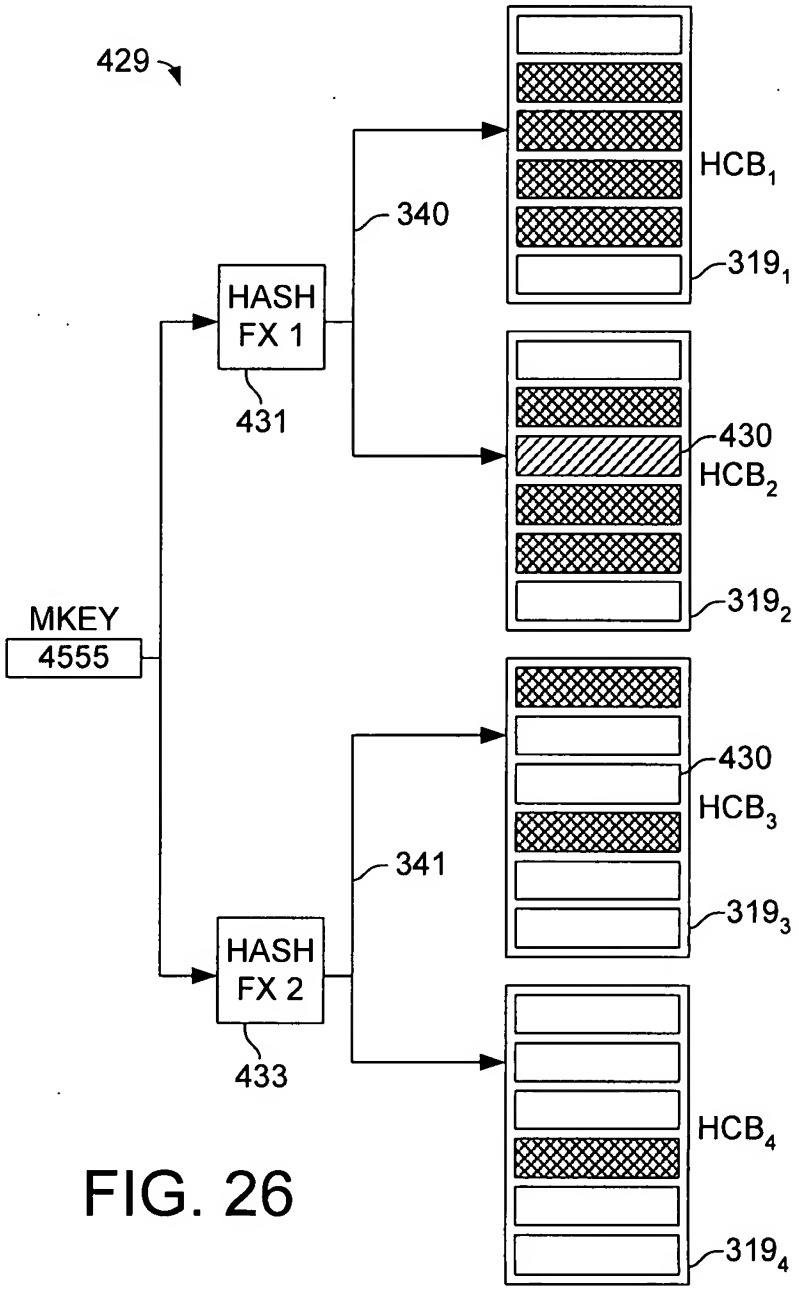

429
HCB1
340
319 1
HASH
FX 1
431
430
HCB2
319 2
MKEY
4555
430
HCB3
341
319 3
HASH
FX 2
433
HCB4
319 4

FIG. 26

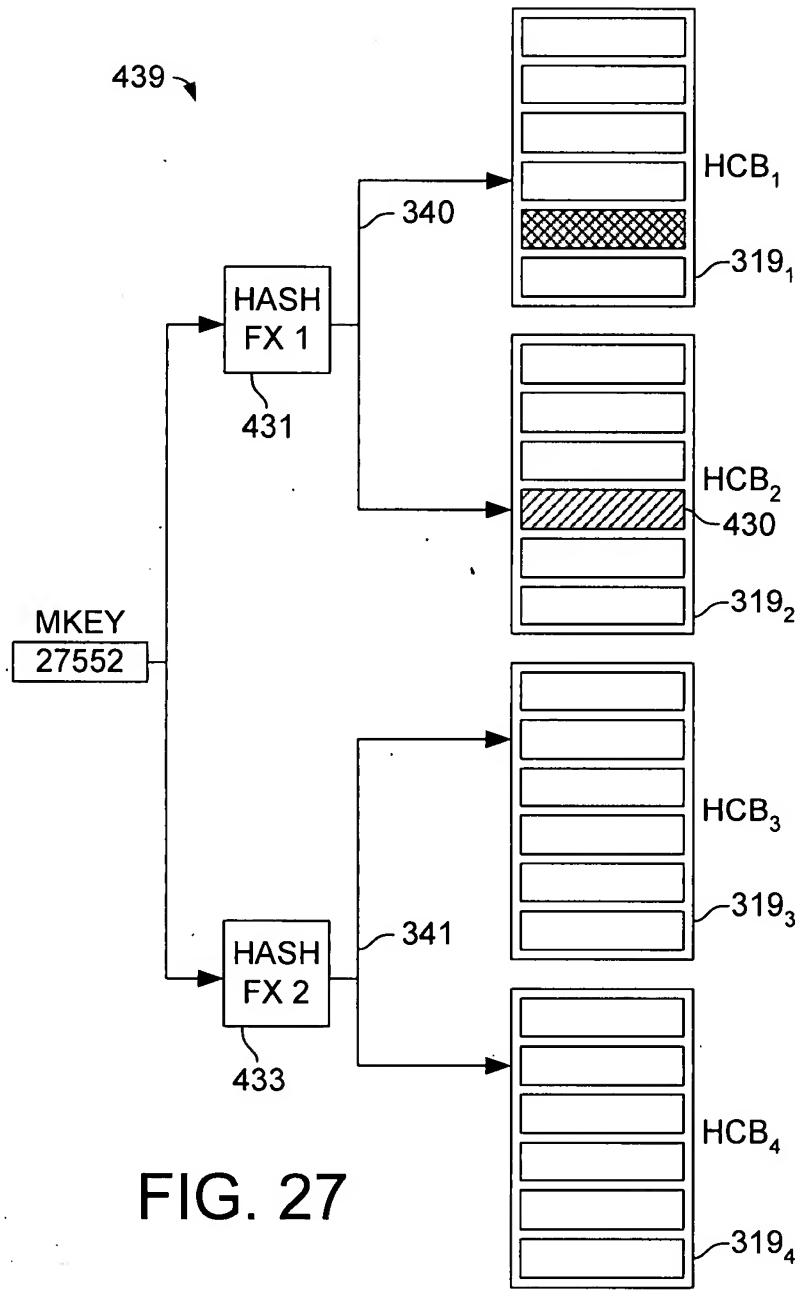

439
HCB1
340
319 1
HASH FX 1
431
HCB2
430
319 2
MKEY
27552
HCB3
319 3
341
HASH FX 2
433
HCB4
319 4

FIG. 27

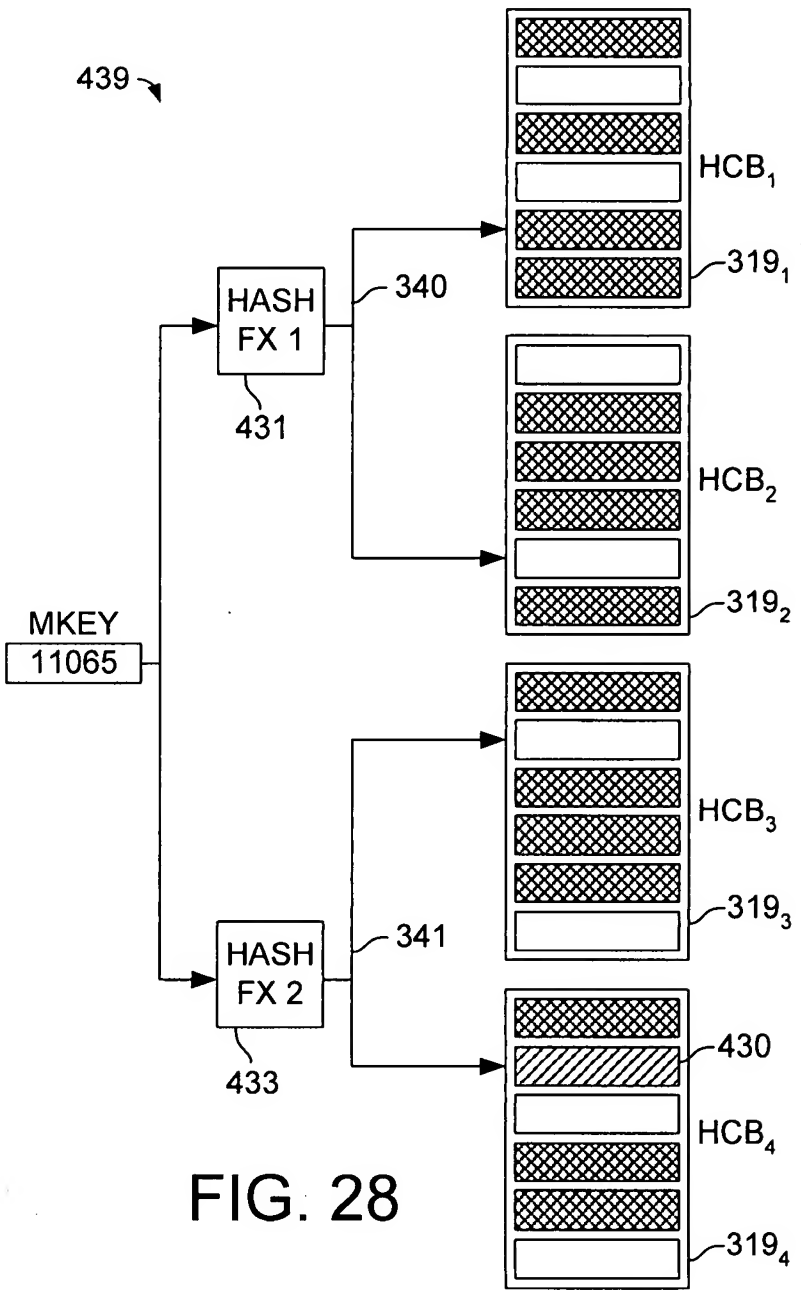
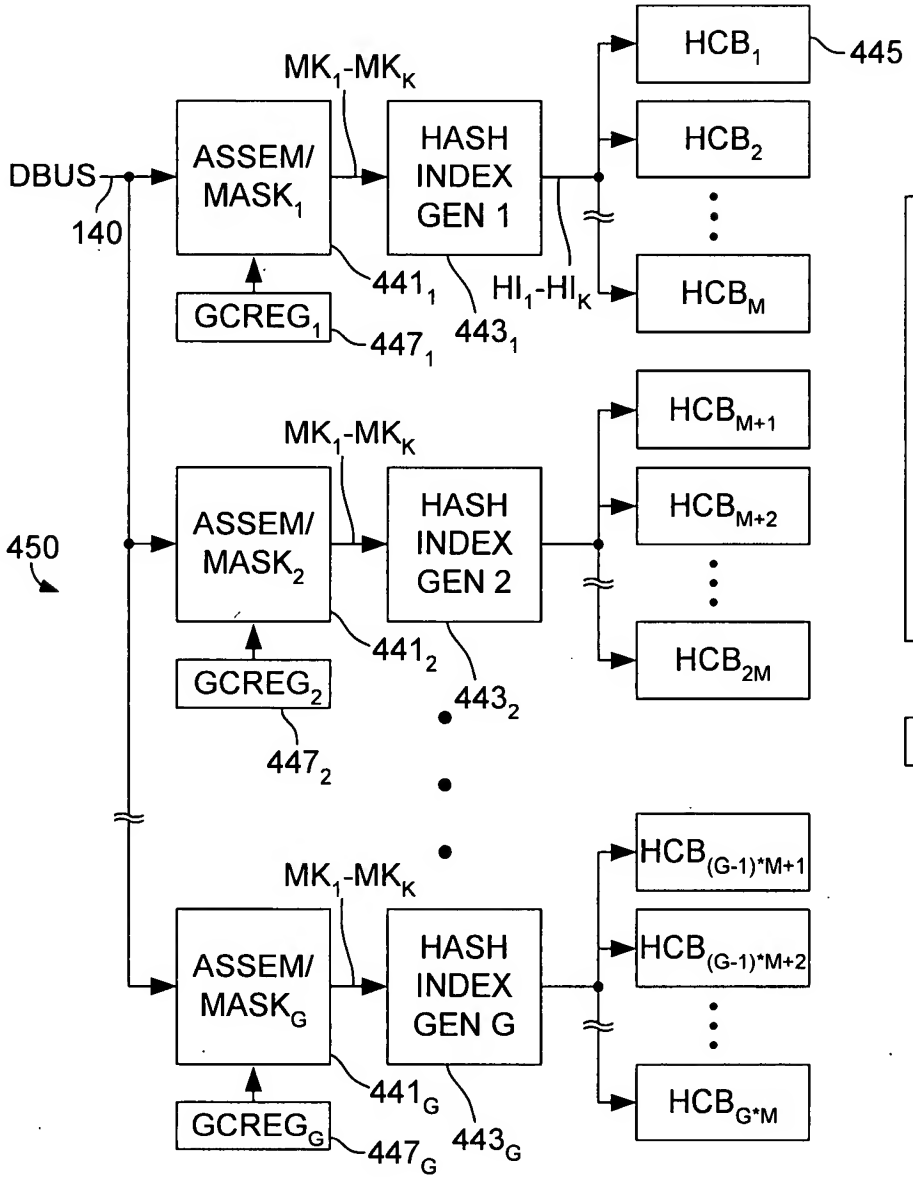

439
HCB1
319 1
340
HASH FX 1
431
HCB2
319 2
MKEY
11065
HCB3
319 3
341
HASH FX 2
433
430
HCB4
319 4

FIG. 28

FIG. 29


DBUS
140
450
ASSEM/ MASK$_1$
HASH INDEX GEN 1
MK$_1$-MK$_K$
GCREG$_1$
447$_1$
441$_1$
443$_1$
HI$_1$-HI$_K$
HCB$_1$
HCB$_2$
HCB$_M$
445
ASSEM/ MASK$_2$
HASH INDEX GEN 2
GCREG$_2$
447$_2$
441$_2$
443$_2$
HCB$_{M+1}$
HCB$_{M+2}$
HCB$_{2M}$
ASSEM/ MASK$_G$
HASH INDEX GEN G
GCREG$_G$
447$_G$
441$_G$
443$_G$
HCB$_{(G-1)*M+1}$
HCB$_{(G-1)*M+2}$
HCB$_{G*M}$

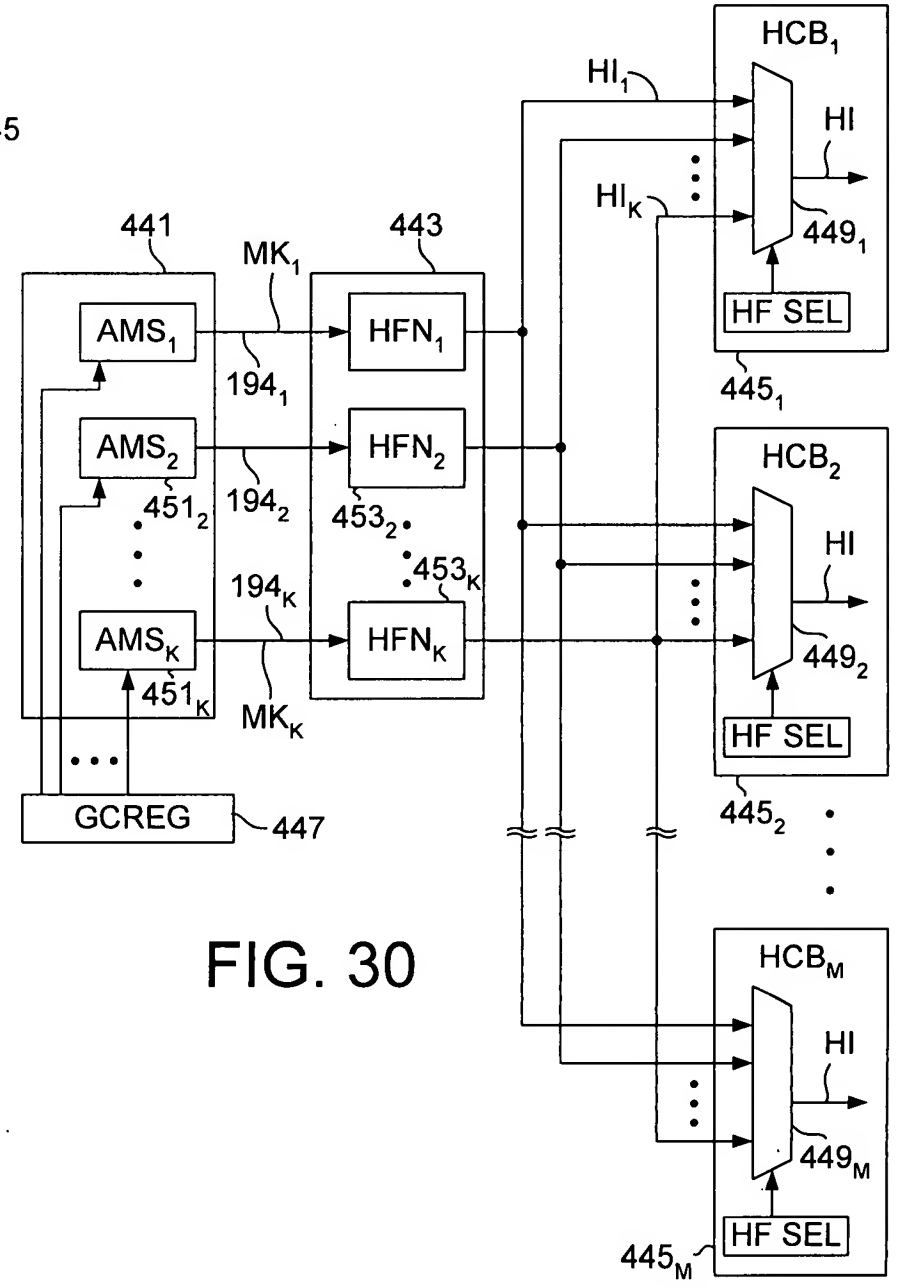

441
AMS$_1$
AMS$_2$
451$_2$
AMS$_K$
451$_K$
GCREG
447
MK$_1$
194$_1$
194$_2$
194$_K$
MK$_K$
443
HFN$_1$
HFN$_2$
453$_2$
453$_K$
HFN$_K$
HI$_1$
HI$_K$
HCB$_1$
HI
449$_1$
HF SEL
445$_1$
HCB$_2$
HI
449$_2$
HF SEL
445$_2$
HCB$_M$
HI
449$_M$
HF SEL
445$_M$

FIG. 30

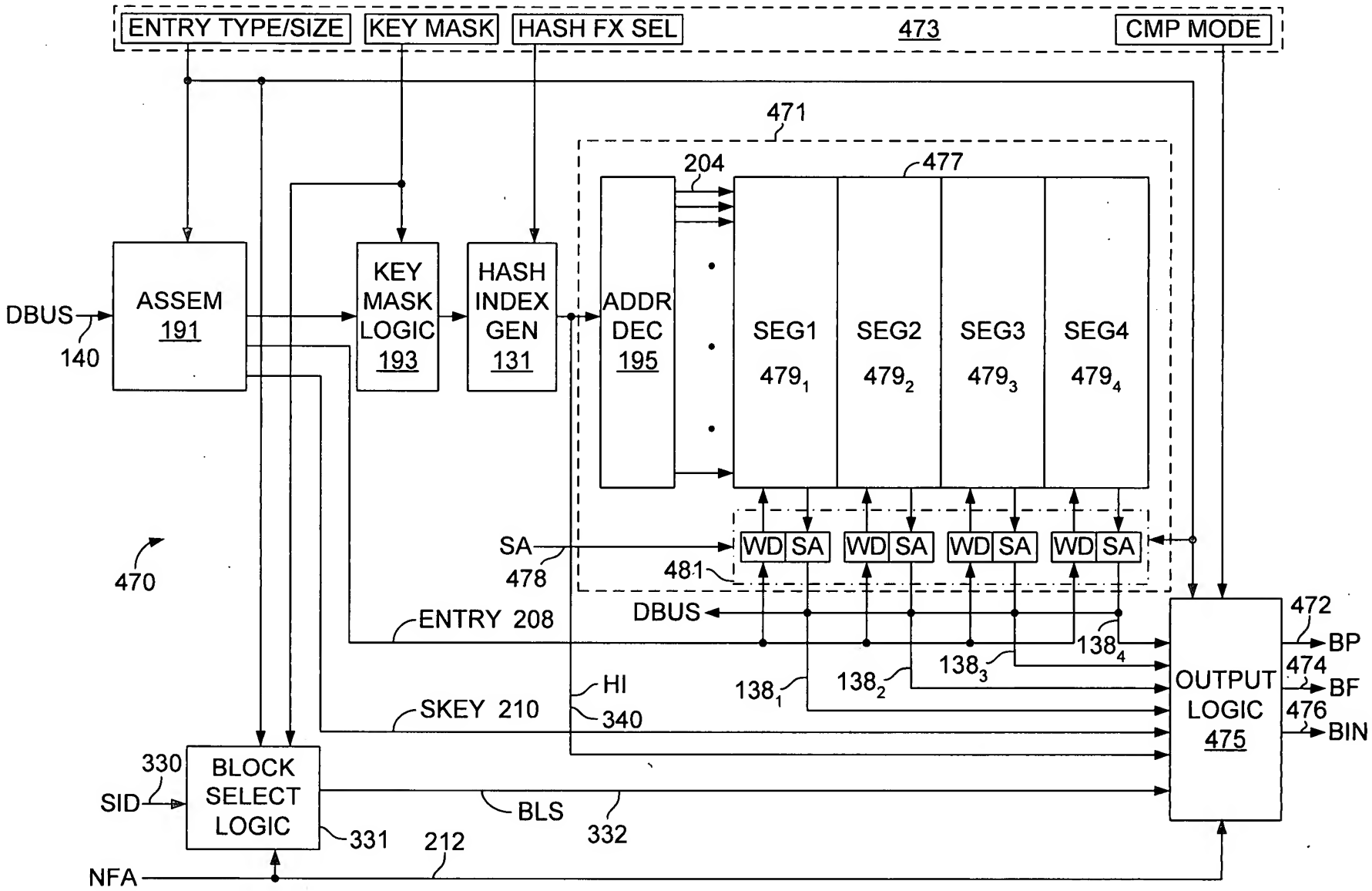

ENTRY TYPE/SIZE
KEY MASK
HASH FX SEL
473
CMP MODE
471
204
477
DBUS
140
ASSEM
191
KEY
MASK
LOGIC
193
HASH
INDEX
GEN
131
ADDR
DEC
195
SEG1
479$_1$
SEG2
479$_2$
SEG3
479$_3$
SEG4
479$_4$
WD
SA
470
SA
478
481
DBUS
ENTRY 208
472
BP
474
BF
476
BIN
OUTPUT
LOGIC
475
138$_1$
138$_2$
138$_3$
138$_4$
HI
340
SKEY 210
330
SID
BLOCK
SELECT
LOGIC
331
BLS
332
212
NFA

FIG. 31

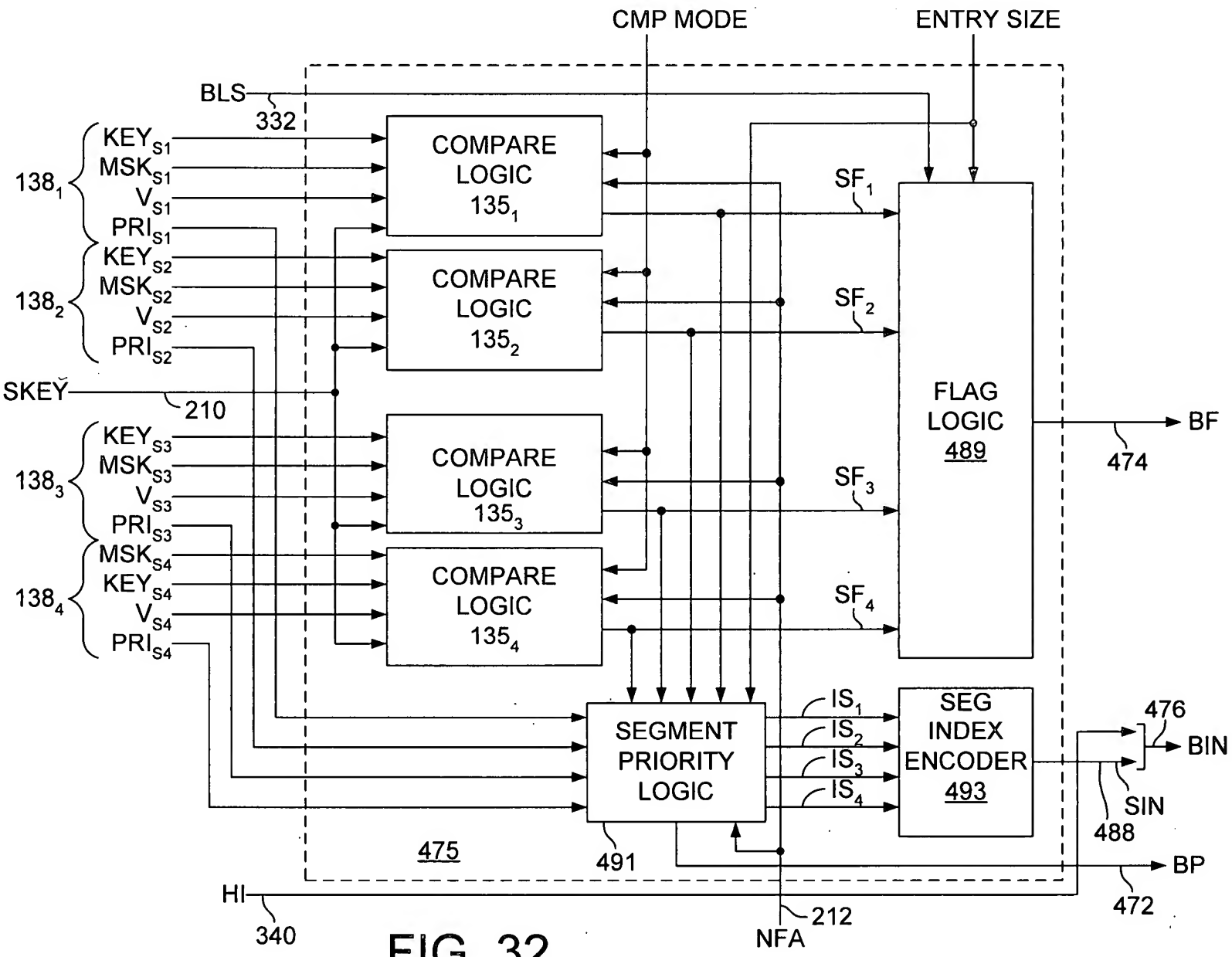

CMP MODE
ENTRY SIZE
BLS
332
KEY$_{S1}$
MSK$_{S1}$
V$_{S1}$
PRI$_{S1}$
138$_1$
KEY$_{S2}$
MSK$_{S2}$
V$_{S2}$
PRI$_{S2}$
138$_2$
SKEY
210
KEY$_{S3}$
MSK$_{S3}$
V$_{S3}$
PRI$_{S3}$
138$_3$
MSK$_{S4}$
KEY$_{S4}$
V$_{S4}$
PRI$_{S4}$
138$_4$
COMPARE LOGIC 135$_1$
COMPARE LOGIC 135$_2$
COMPARE LOGIC 135$_3$
COMPARE LOGIC 135$_4$
SF$_1$
SF$_2$
SF$_3$
SF$_4$
FLAG LOGIC 489
BF
474
SEGMENT PRIORITY LOGIC
IS$_1$
IS$_2$
IS$_3$
IS$_4$
SEG INDEX ENCODER 493
476
BIN
SIN
488
BP
472
475
491
HI
340
212
NFA

FIG. 32

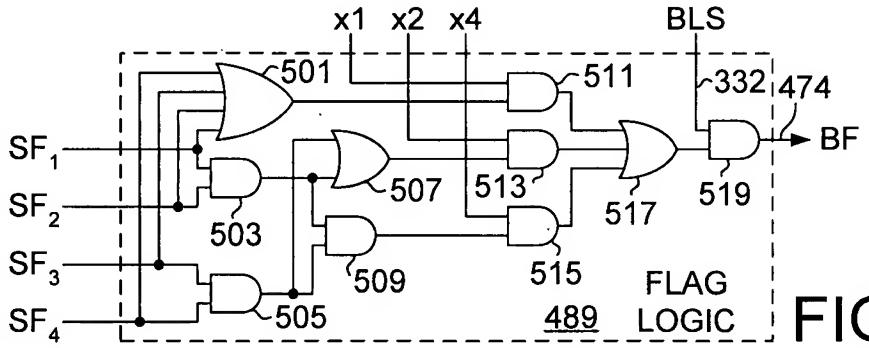


FIG. 33

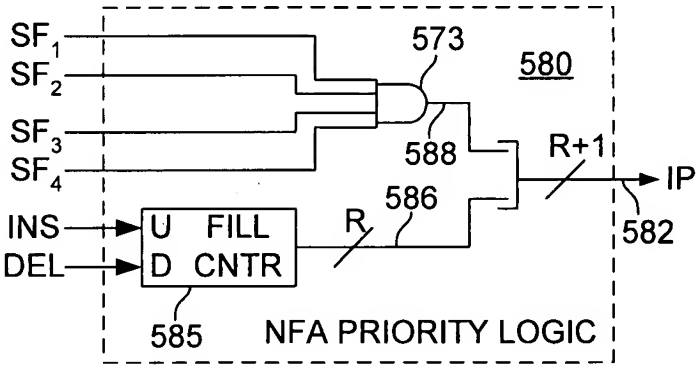


FIG. 35

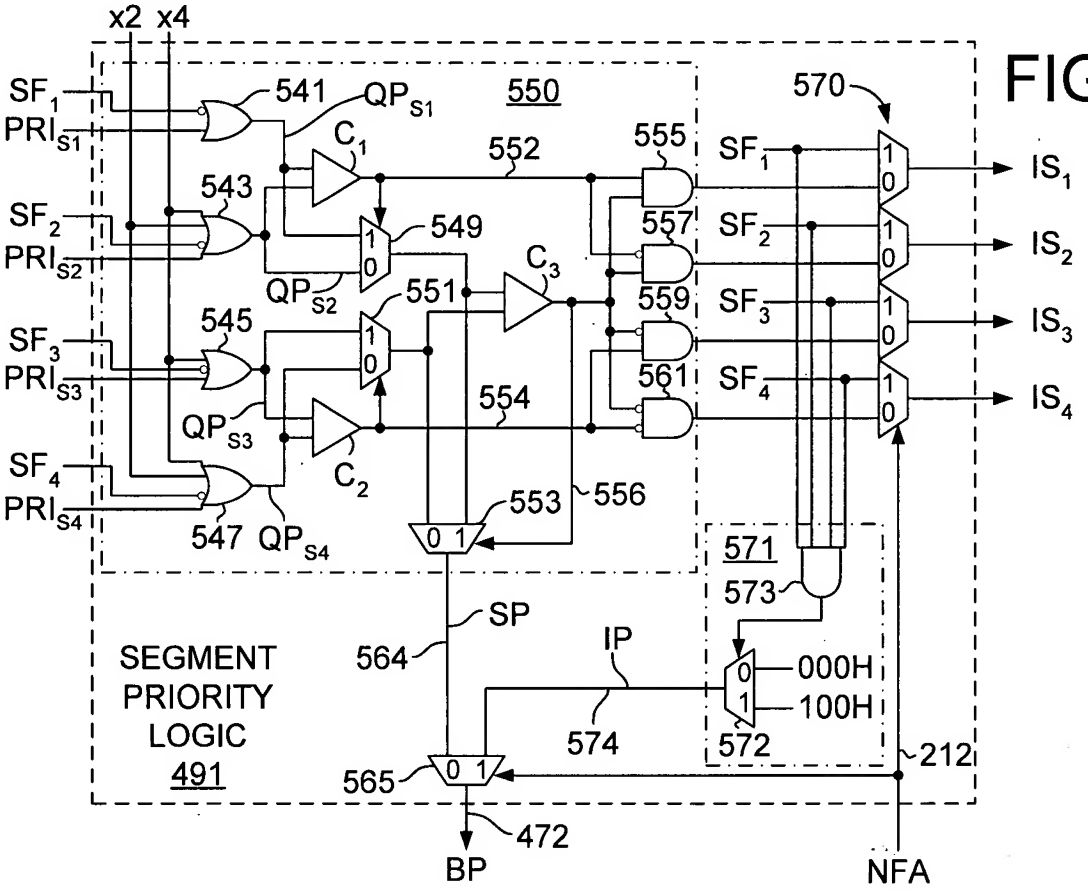


FIG. 34

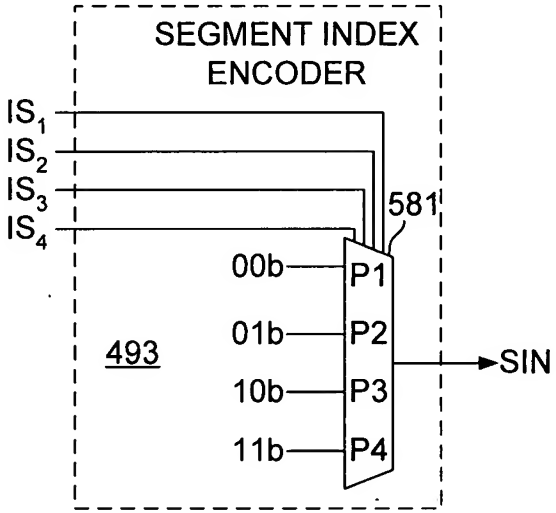


FIG. 36

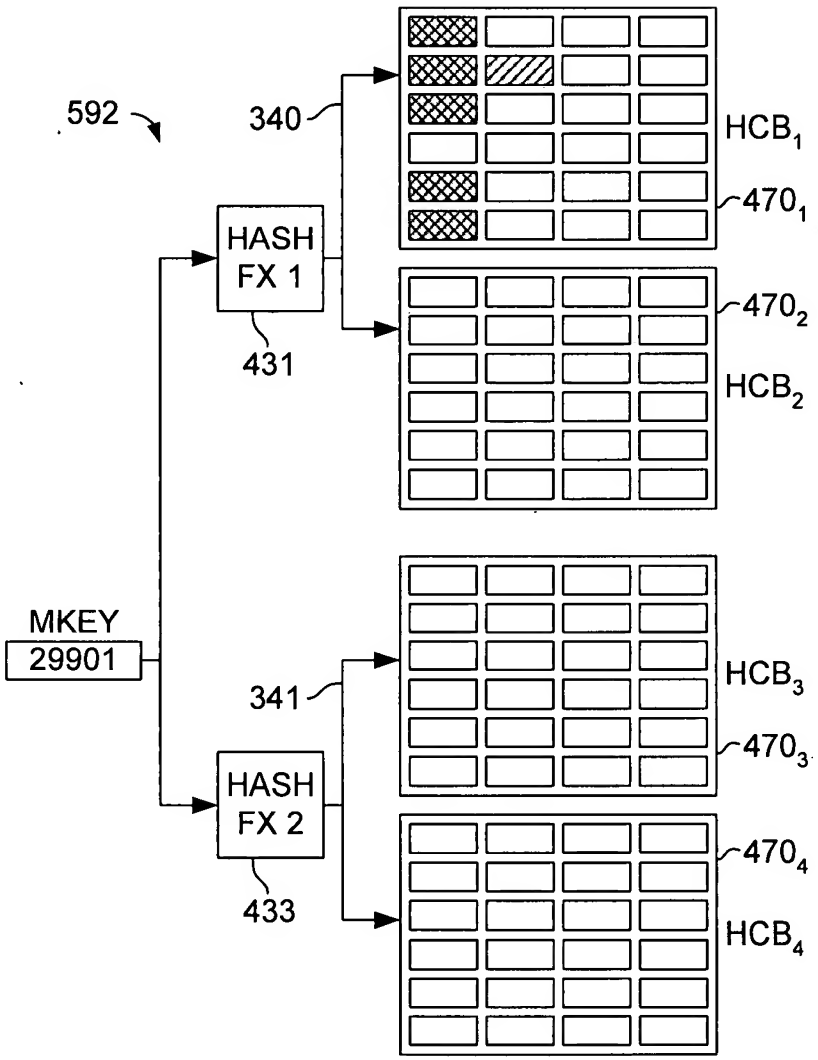

592
340
HCB1
4701
HASH
FX 1
4702
HCB2
431
MKEY
29901
341
HCB3
4703
HASH
FX 2
4704
HCB4
433

FIG. 37

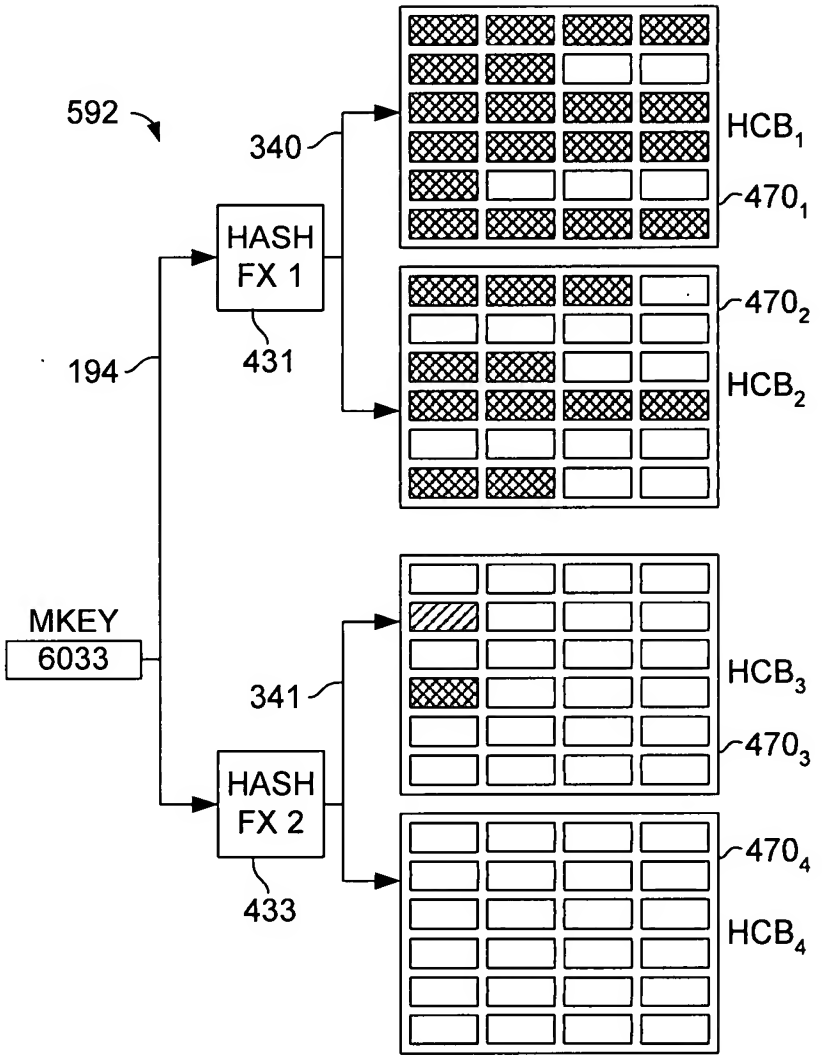

592
340
HCB1
4701
HASH
FX 1
4702
194
HCB2
431
MKEY
6033
341
HCB3
4703
HASH
FX 2
4704
HCB4
433

FIG. 38

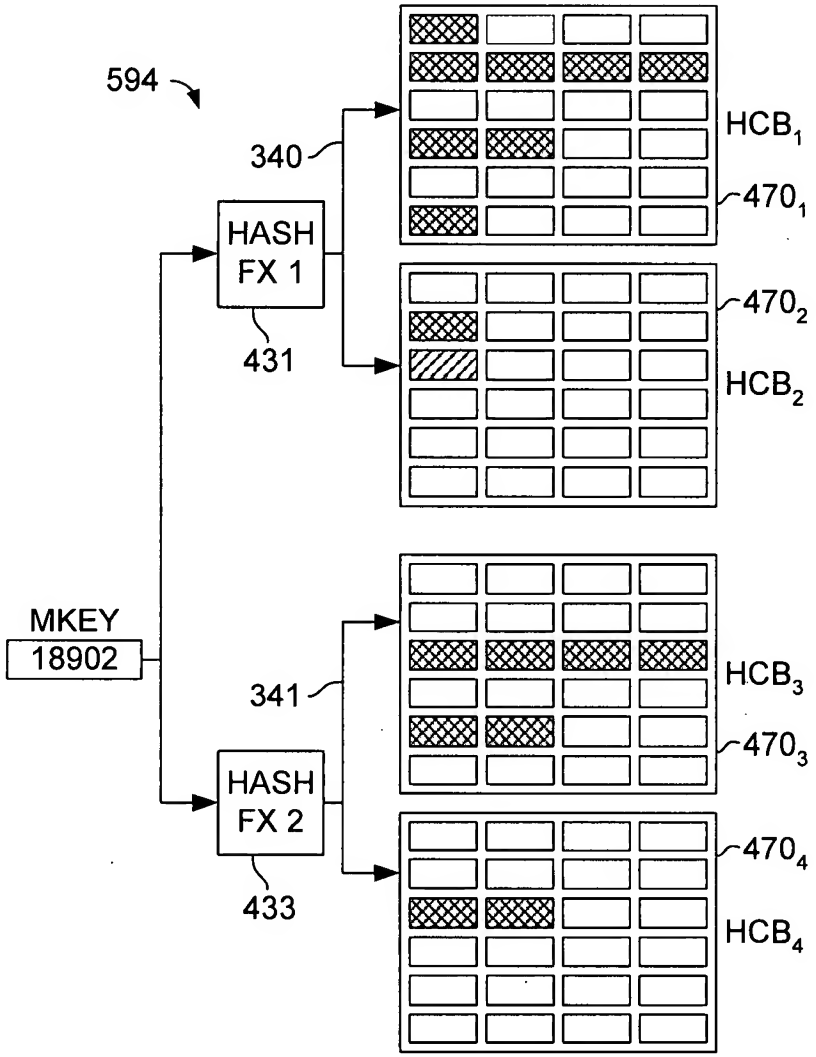

594
340
HASH
FX 1
431
MKEY
18902
341
HASH
FX 2
433
HCB1
4701
4702
HCB2
HCB3
4703
4704
HCB4

FIG.39

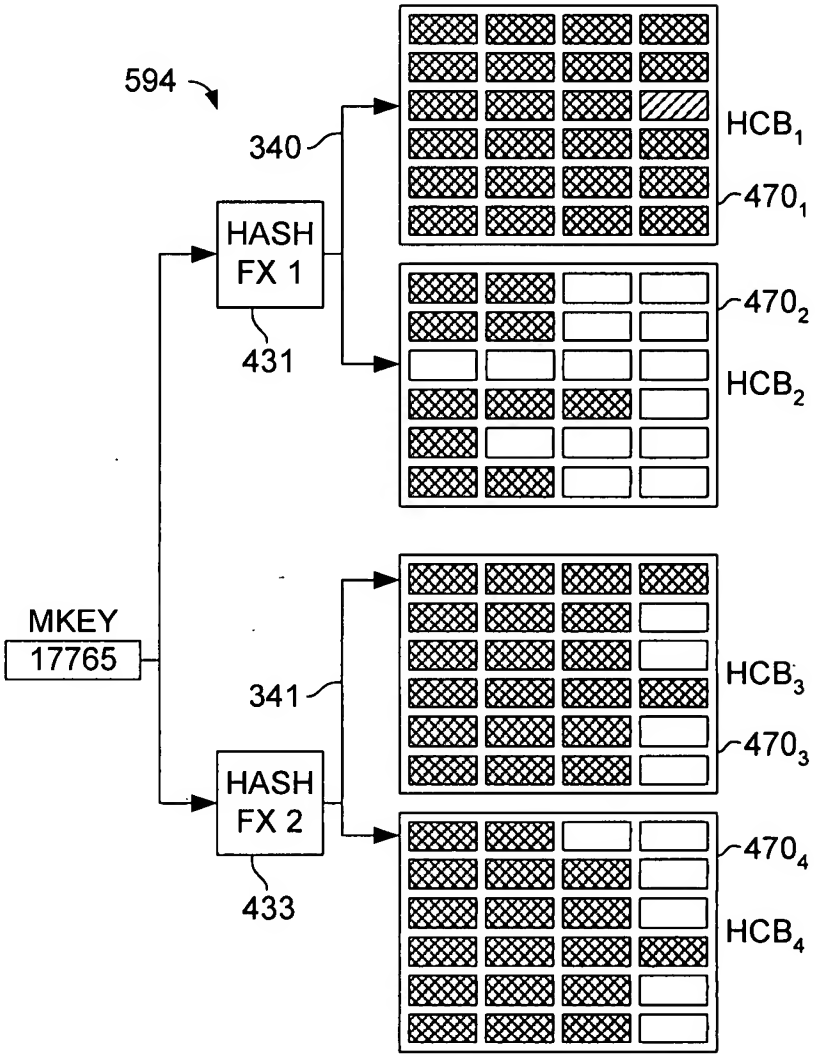

594
340
HASH
FX 1
431
MKEY
17765
341
HASH
FX 2
433
HCB1
4701
4702
HCB2
HCB3
4703
4704
HCB4

FIG. 40

FIG. 41

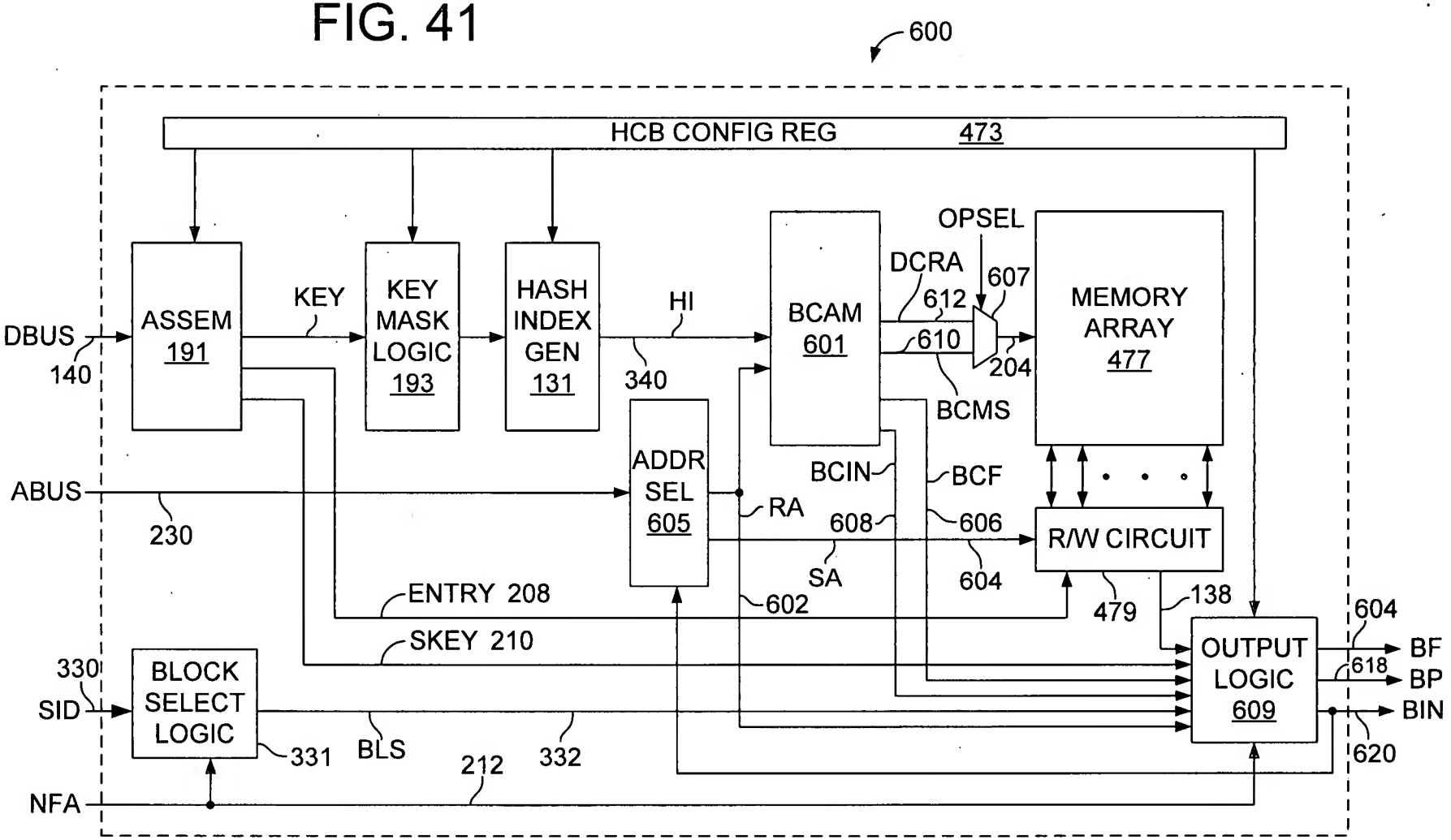
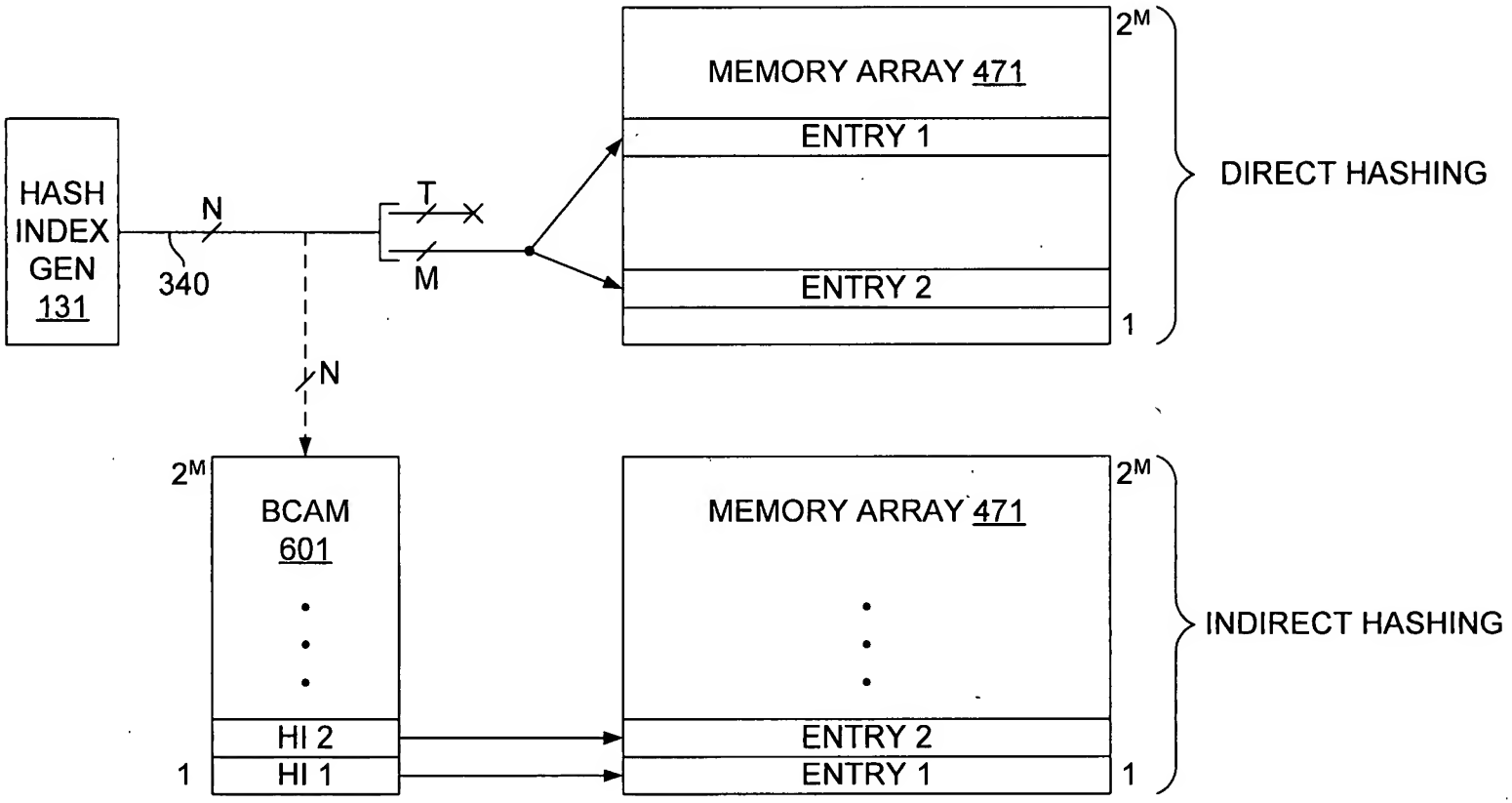

600
HCB CONFIG REG 473
ASSEM 191
KEY
KEY MASK LOGIC 193
HASH INDEX GEN 131
HI
340
BCAM 601
OPSEL
DCRA
612
607
610
204
MEMORY ARRAY 477
BCMS
DBUS
140
ABUS
230
ADDR SEL 605
BCIN
BCF
RA
608
606
R/W CIRCUIT
SA
604
ENTRY 208
602
479
138
SKEY 210
OUTPUT LOGIC 609
604
618
BF
BP
BIN
620
330
SID
BLOCK SELECT LOGIC
331
BLS
212
332
NFA

FIG. 42


HASH INDEX GEN 131
N
340
T
M
N
MEMORY ARRAY 471
ENTRY 1
ENTRY 2
2M
1
DIRECT HASHING
2M
BCAM 601
HI 2
HI 1
1
MEMORY ARRAY 471
ENTRY 2
ENTRY 1
2M
1
INDIRECT HASHING

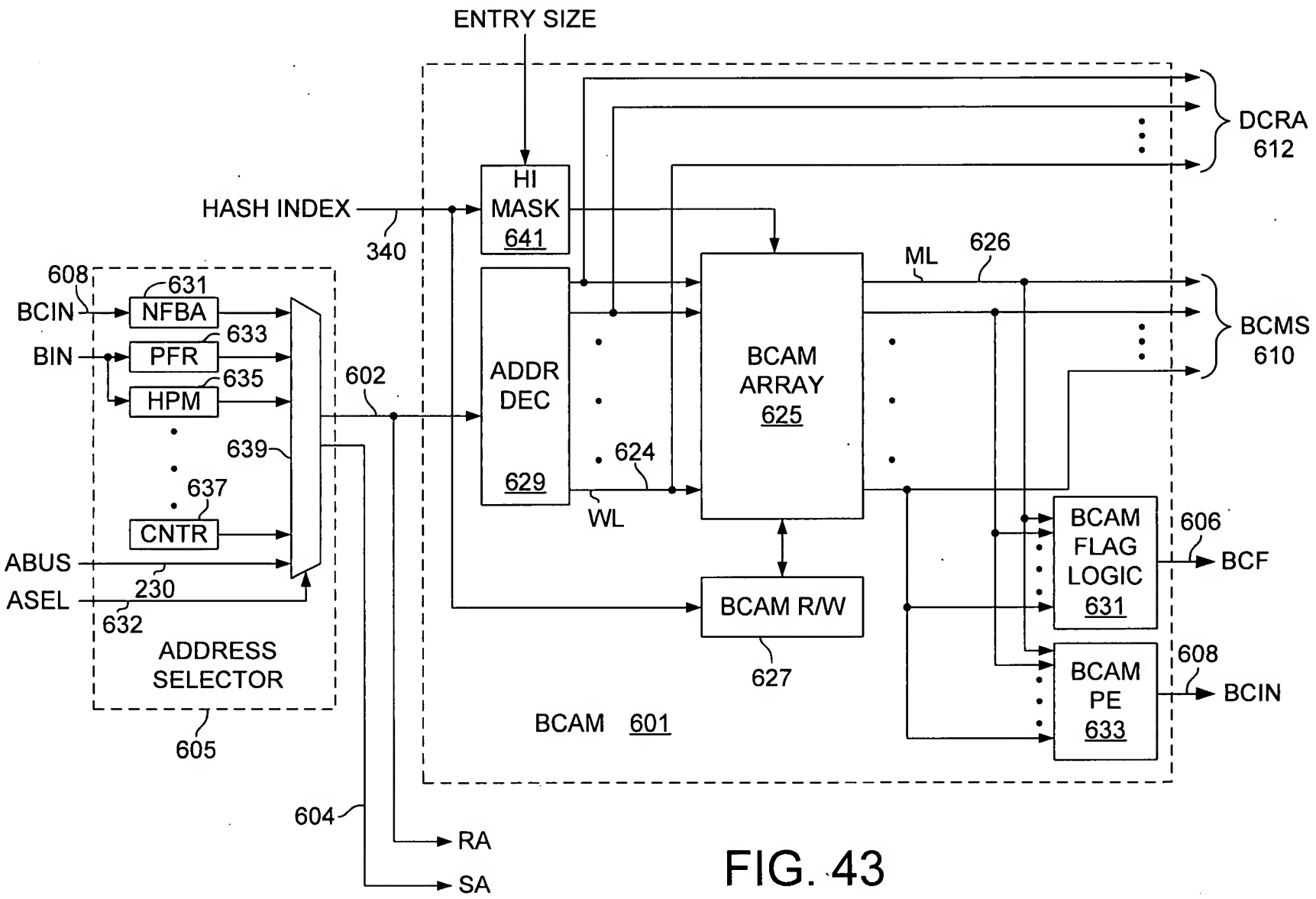

ENTRY SIZE
HASH INDEX
340
HI
MASK
641
DCRA
612
608
631
BCIN
NFBA
633
BIN
PFR
635
HPM
602
639
637
CNTR
ABUS
230
ASEL
632
ADDRESS
SELECTOR
605
ADDR
DEC
629
624
WL
BCAM
ARRAY
625
ML
626
BCMS
610
BCAM R/W
627
BCAM
FLAG
LOGIC
631
606
BCF
BCAM
PE
633
608
BCIN
BCAM 601
604
RA
SA

FIG. 43

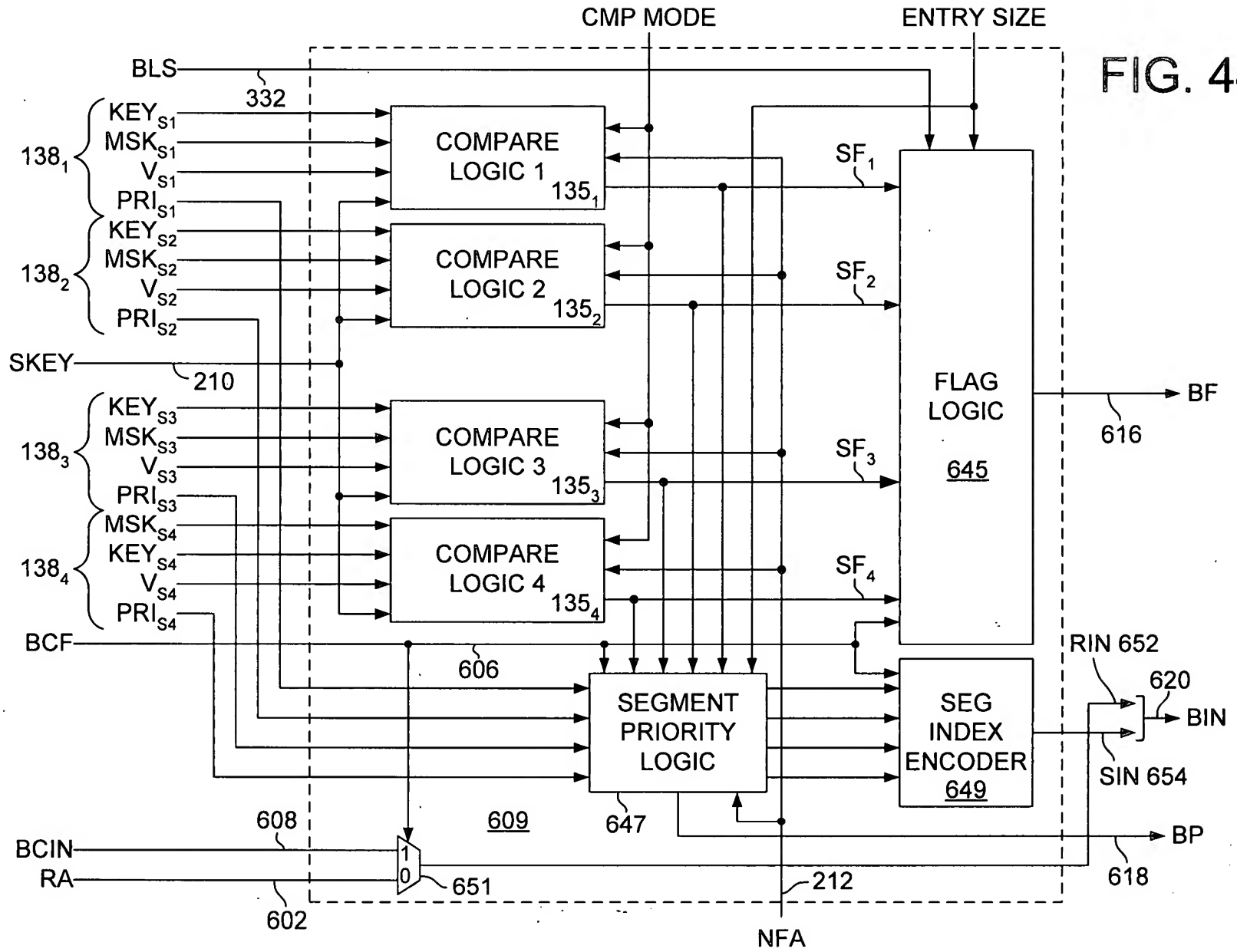

CMP MODE
ENTRY SIZE
BLS
332
KEY$_{S1}$
MSK$_{S1}$
V$_{S1}$
PRI$_{S1}$
138$_1$
KEY$_{S2}$
MSK$_{S2}$
V$_{S2}$
PRI$_{S2}$
138$_2$
SKEY
210
KEY$_{S3}$
MSK$_{S3}$
V$_{S3}$
PRI$_{S3}$
138$_3$
MSK$_{S4}$
KEY$_{S4}$
V$_{S4}$
PRI$_{S4}$
138$_4$
BCF
606
COMPARE LOGIC 1
135$_1$
COMPARE LOGIC 2
135$_2$
COMPARE LOGIC 3
135$_3$
COMPARE LOGIC 4
135$_4$
SF$_1$
SF$_2$
SF$_3$
SF$_4$
FLAG LOGIC
645
BF
616
SEGMENT PRIORITY LOGIC
647
SEG INDEX ENCODER
649
RIN 652
620
BIN
SIN 654
BP
618
608
609
BCIN
RA
602
1
0
651
212
NFA

FIG. 44

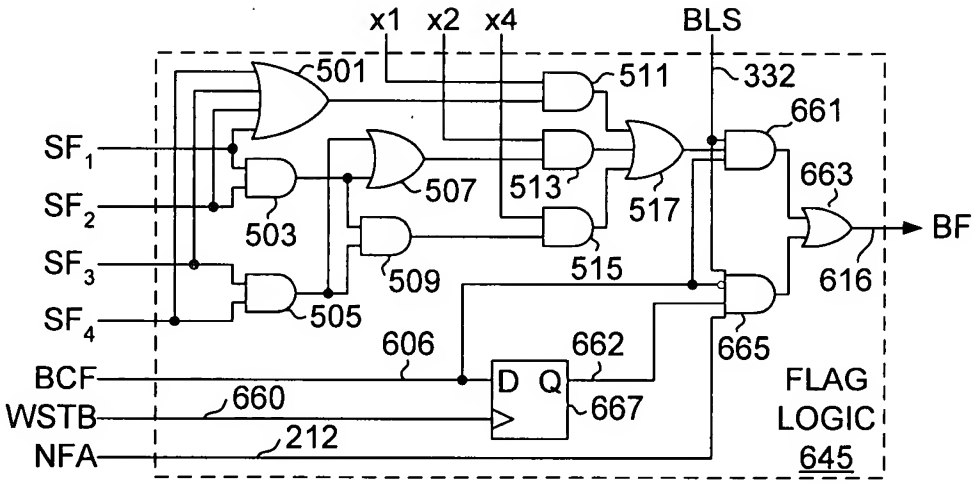


FIG. 45

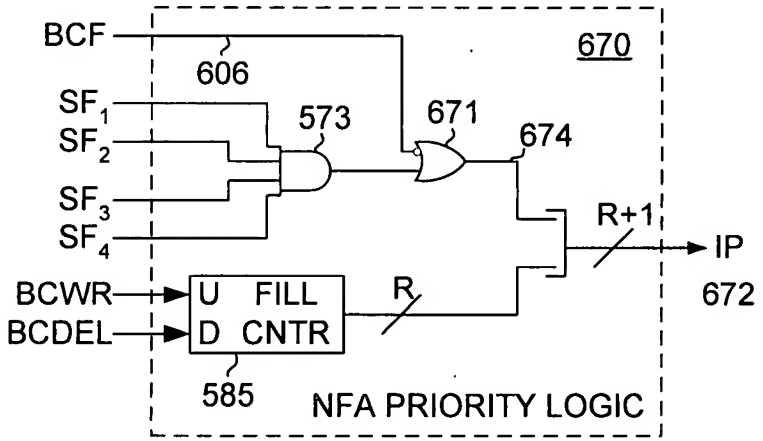


FIG. 46

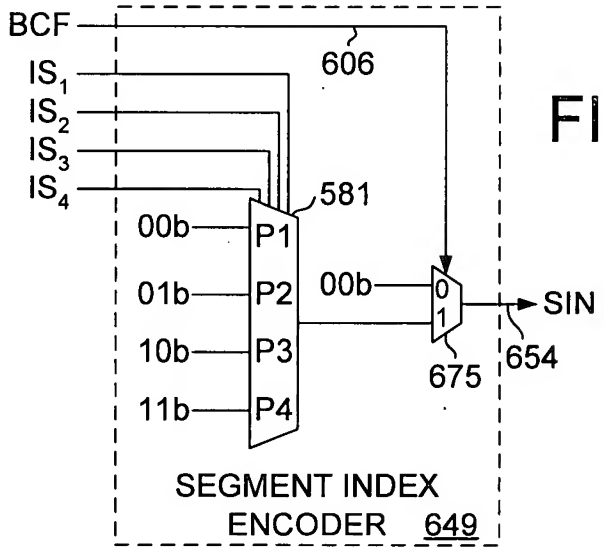


FIG. 47

FIG. 48

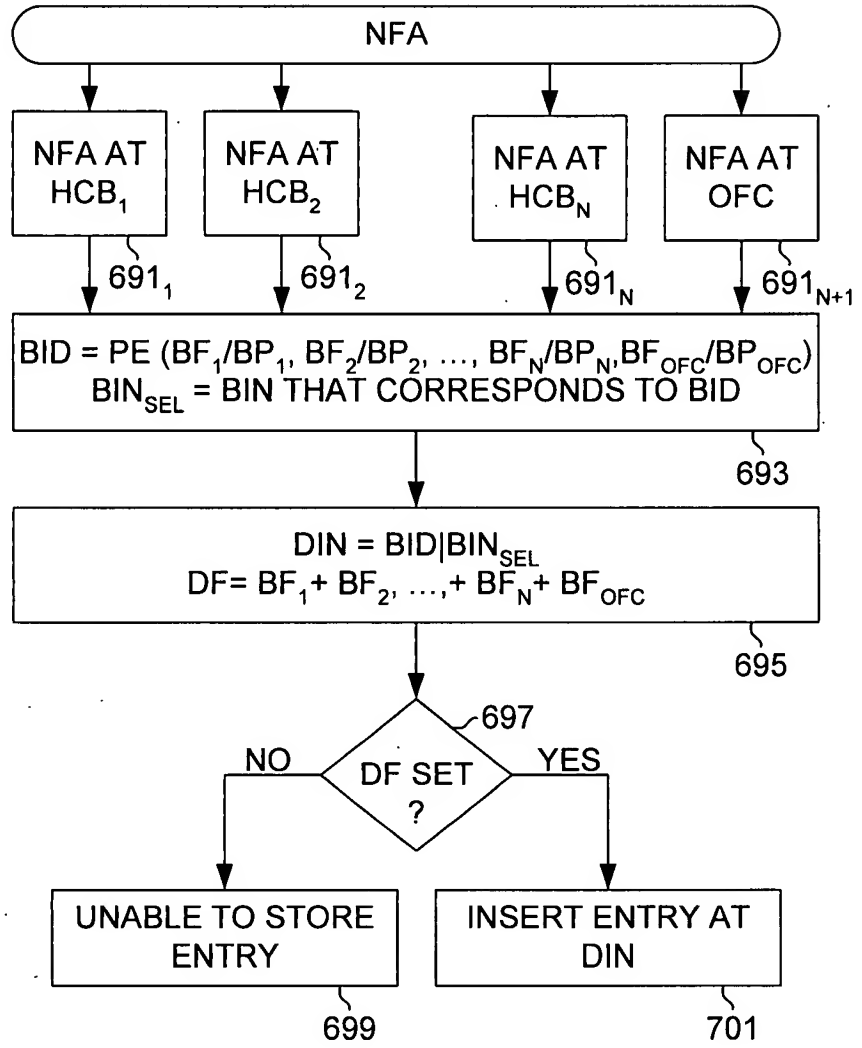
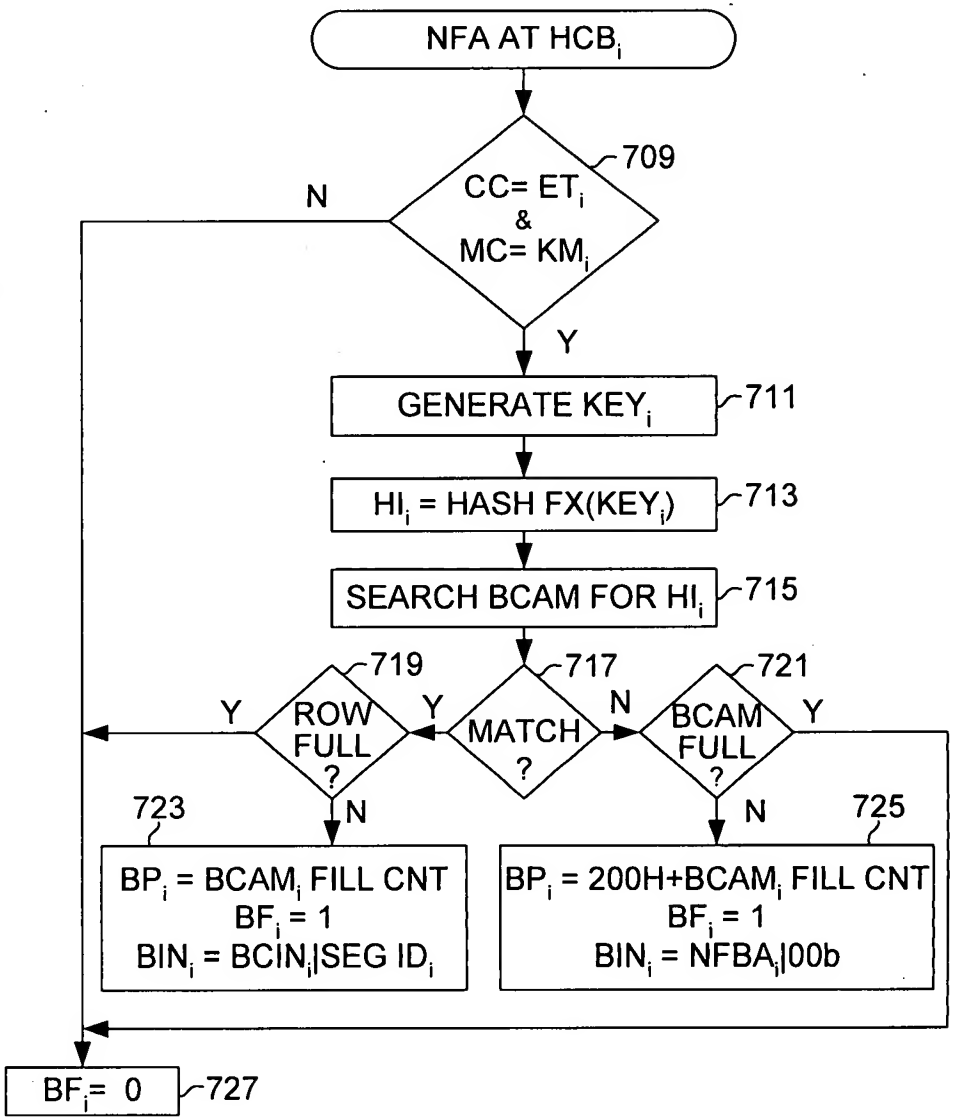

NFA
NFA AT HCB1
NFA AT HCB2
NFA AT HCBN
NFA AT OFC
691 1
691 2
691 N
691 N+1
BID = PE (BF1/BP1, BF2/BP2, ..., BFN/BPN,BFOFC/BPOFC)
BINSEL = BIN THAT CORRESPONDS TO BID
693
DIN = BID|BINSEL
DF= BF1+ BF2, ...,+ BFN+ BFOFC
695
697
DF SET ?
NO
YES
UNABLE TO STORE ENTRY
INSERT ENTRY AT DIN
699
701

FIG. 49


NFA AT HCBi
709
CC= ETi & MC= KMi
N
Y
GENERATE KEYi
711
HIi = HASH FX(KEYi)
713
SEARCH BCAM FOR HIi
715
719
ROW FULL ?
717
MATCH ?
721
BCAM FULL ?
Y
N
723
BPi = BCAMi FILL CNT
BFi = 1
BINi = BCINi|SEG IDi
725
BPi = 200H+BCAMi FILL CNT
BFi = 1
BINi = NFBAi|00b
BFi= 0
727

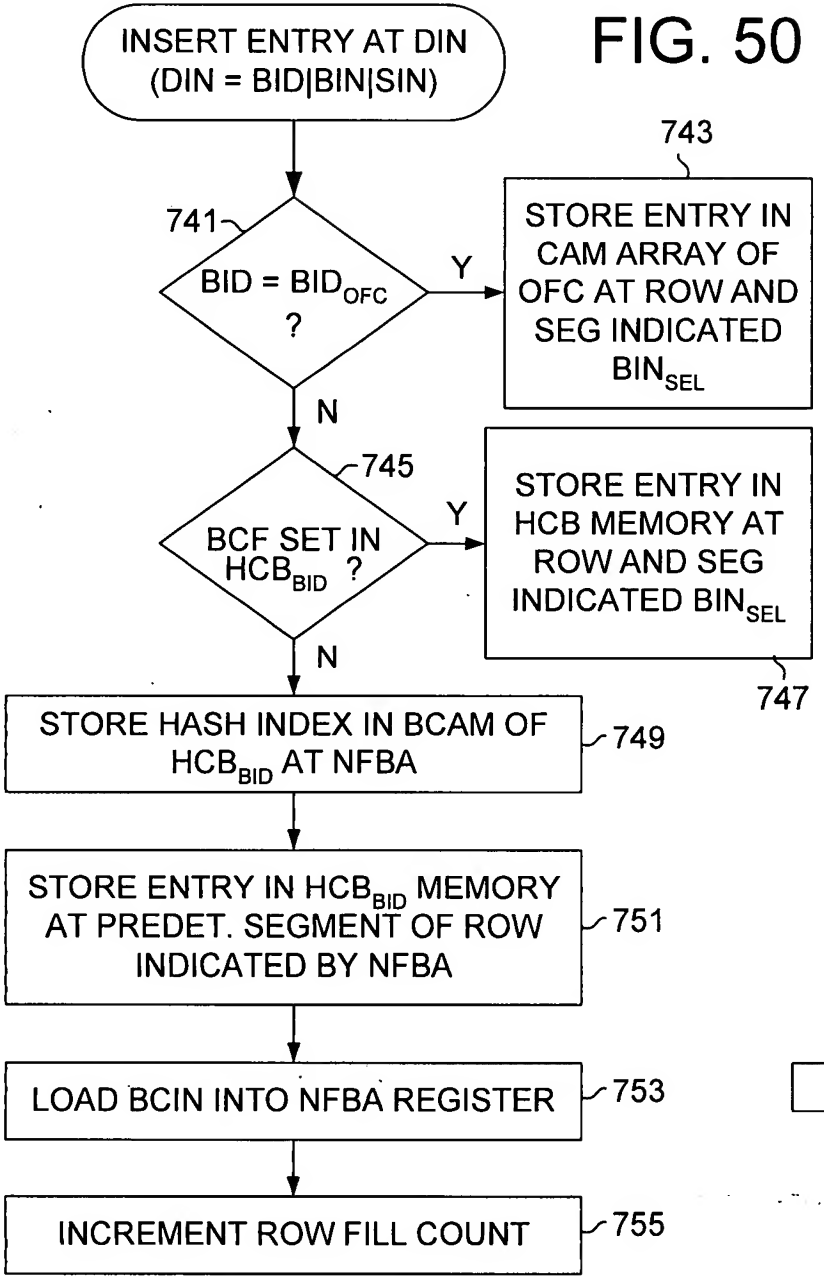

INSERT ENTRY AT DIN
(DIN = BID|BIN|SIN)
741
BID = BID_OFC ?
Y
743
STORE ENTRY IN CAM ARRAY OF OFC AT ROW AND SEG INDICATED BIN_SEL
N
745
BCF SET IN HCB_BID ?
Y
STORE ENTRY IN HCB MEMORY AT ROW AND SEG INDICATED BIN_SEL
747
N
STORE HASH INDEX IN BCAM OF HCB_BID AT NFBA
749
STORE ENTRY IN HCB_BID MEMORY AT PREDET. SEGMENT OF ROW INDICATED BY NFBA
751
LOAD BCIN INTO NFBA REGISTER
753
INCREMENT ROW FILL COUNT
755

FIG. 50

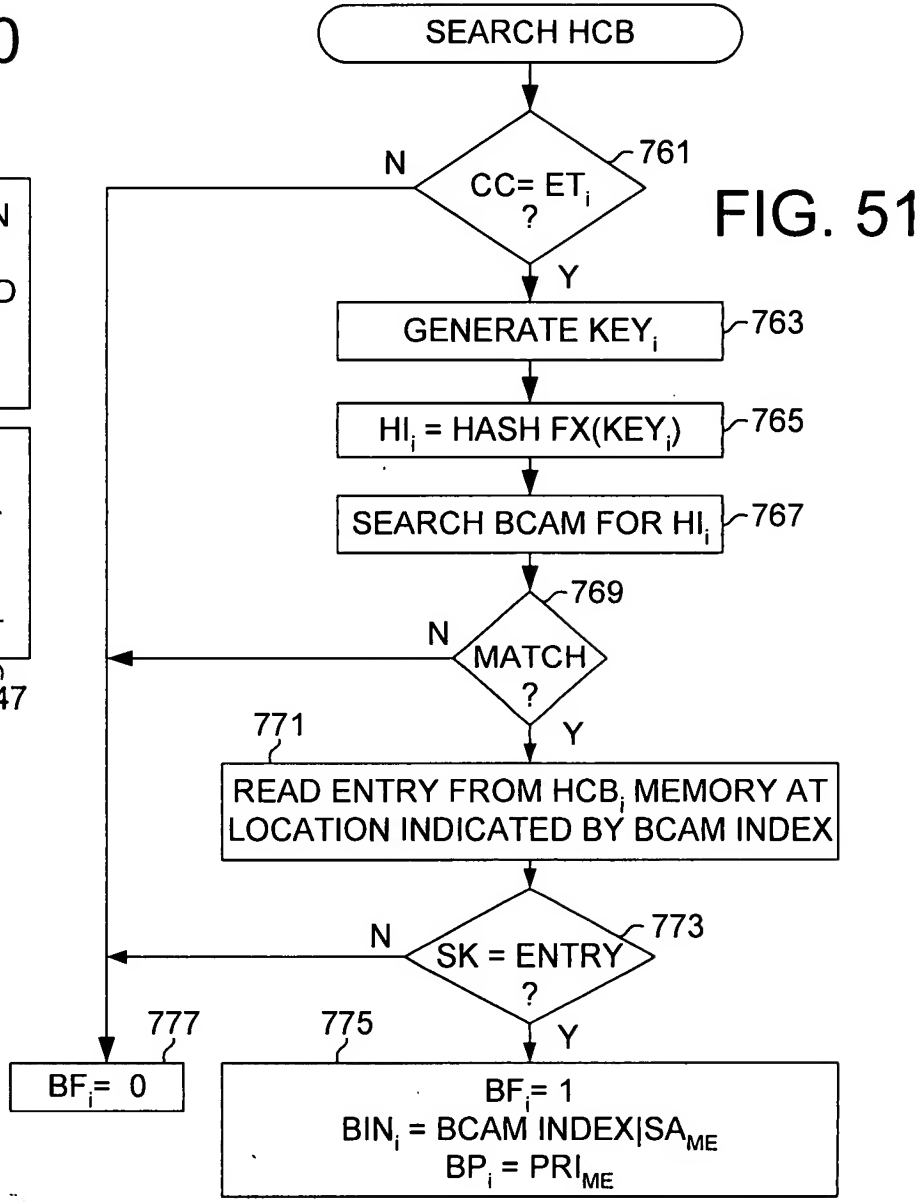

SEARCH HCB
761
N
CC= ET_i ?
Y
GENERATE KEY_i
763
HI_i = HASH FX(KEY_i)
765
SEARCH BCAM FOR HI_i
767
769
N
MATCH ?
Y
771
READ ENTRY FROM HCB_i MEMORY AT LOCATION INDICATED BY BCAM INDEX
773
N
SK = ENTRY ?
Y
777
BF_i= 0
775
BF_i= 1
BIN_i = BCAM INDEX|SA_ME
BP_i = PRI_ME

FIG. 51

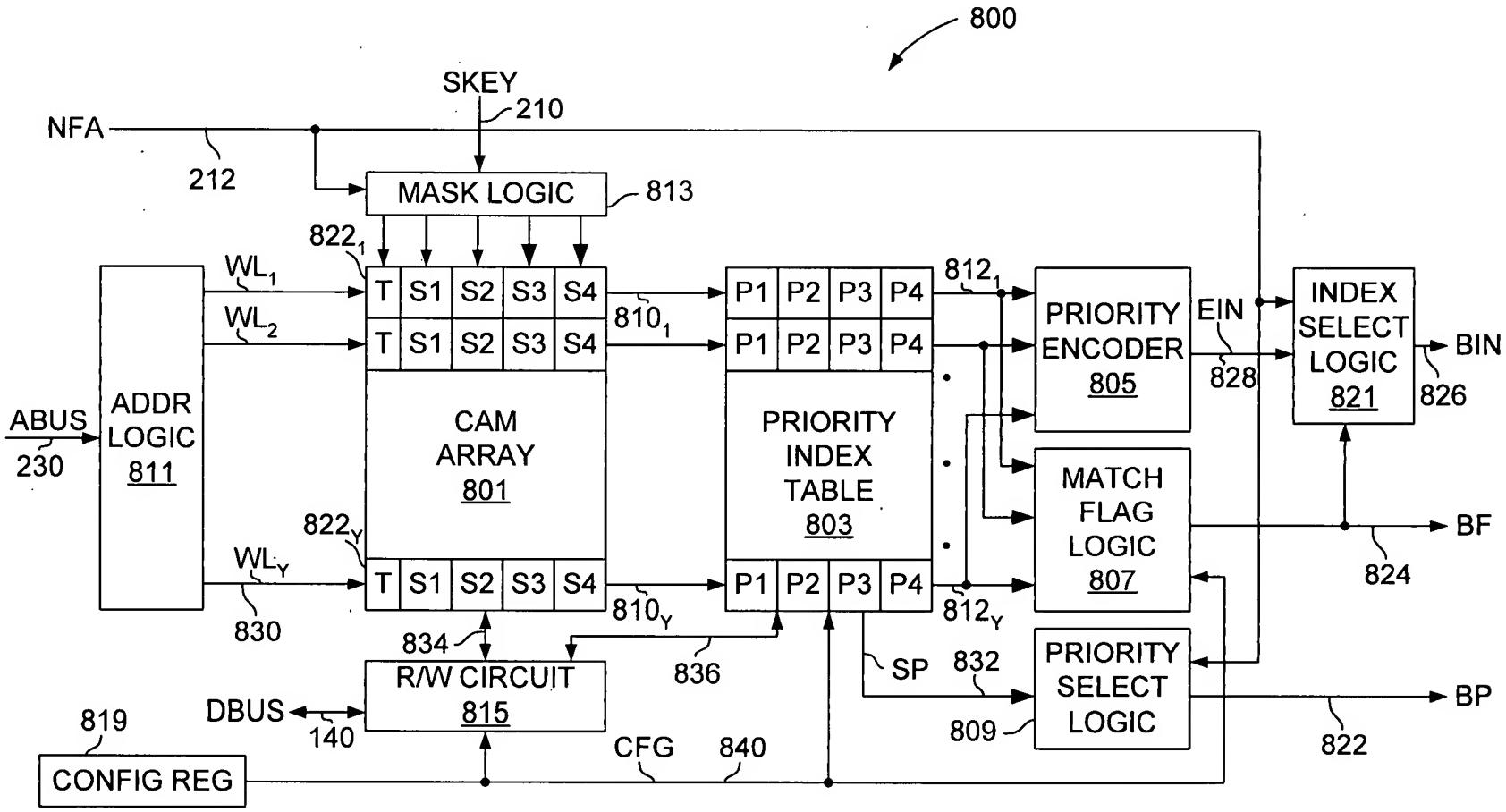

800
SKEY
210
NFA
212
MASK LOGIC
813
822$_1$
WL$_1$
WL$_2$
T S1 S2 S3 S4
T S1 S2 S3 S4
810$_1$
P1 P2 P3 P4
P1 P2 P3 P4
812$_1$
PRIORITY ENCODER 805
EIN
828
INDEX SELECT LOGIC 821
BIN
826
ABUS
230
ADDR LOGIC 811
CAM ARRAY 801
PRIORITY INDEX TABLE 803
MATCH FLAG LOGIC 807
BF
824
822$_Y$
WL$_Y$
830
T S1 S2 S3 S4
810$_Y$
P1 P2 P3 P4
812$_Y$
834
836
R/W CIRCUIT 815
DBUS
140
SP
832
PRIORITY SELECT LOGIC
BP
822
809
819
CONFIG REG
CFG
840

FIG. 52

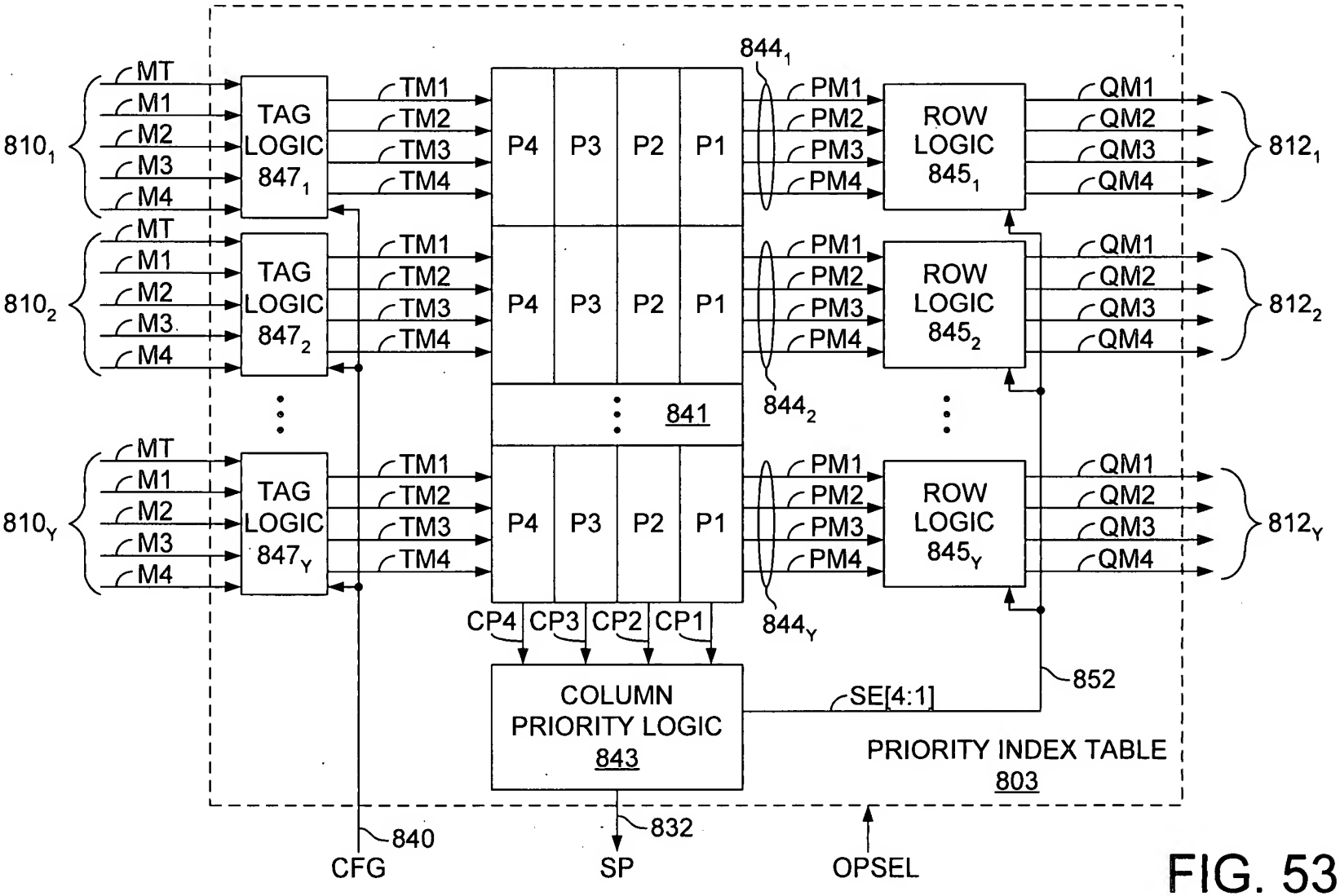

810_1
810_2
810_Y
MT
M1
M2
M3
M4
TAG LOGIC 847_1
TAG LOGIC 847_2
TAG LOGIC 847_Y
TM1
TM2
TM3
TM4
P4
P3
P2
P1
841
844_1
844_2
844_Y
PM1
PM2
PM3
PM4
ROW LOGIC 845_1
ROW LOGIC 845_2
ROW LOGIC 845_Y
QM1
QM2
QM3
QM4
812_1
812_2
812_Y
CP4
CP3
CP2
CP1
COLUMN PRIORITY LOGIC 843
SE[4:1]
852
PRIORITY INDEX TABLE 803
840
CFG
832
SP
OPSEL

FIG. 53

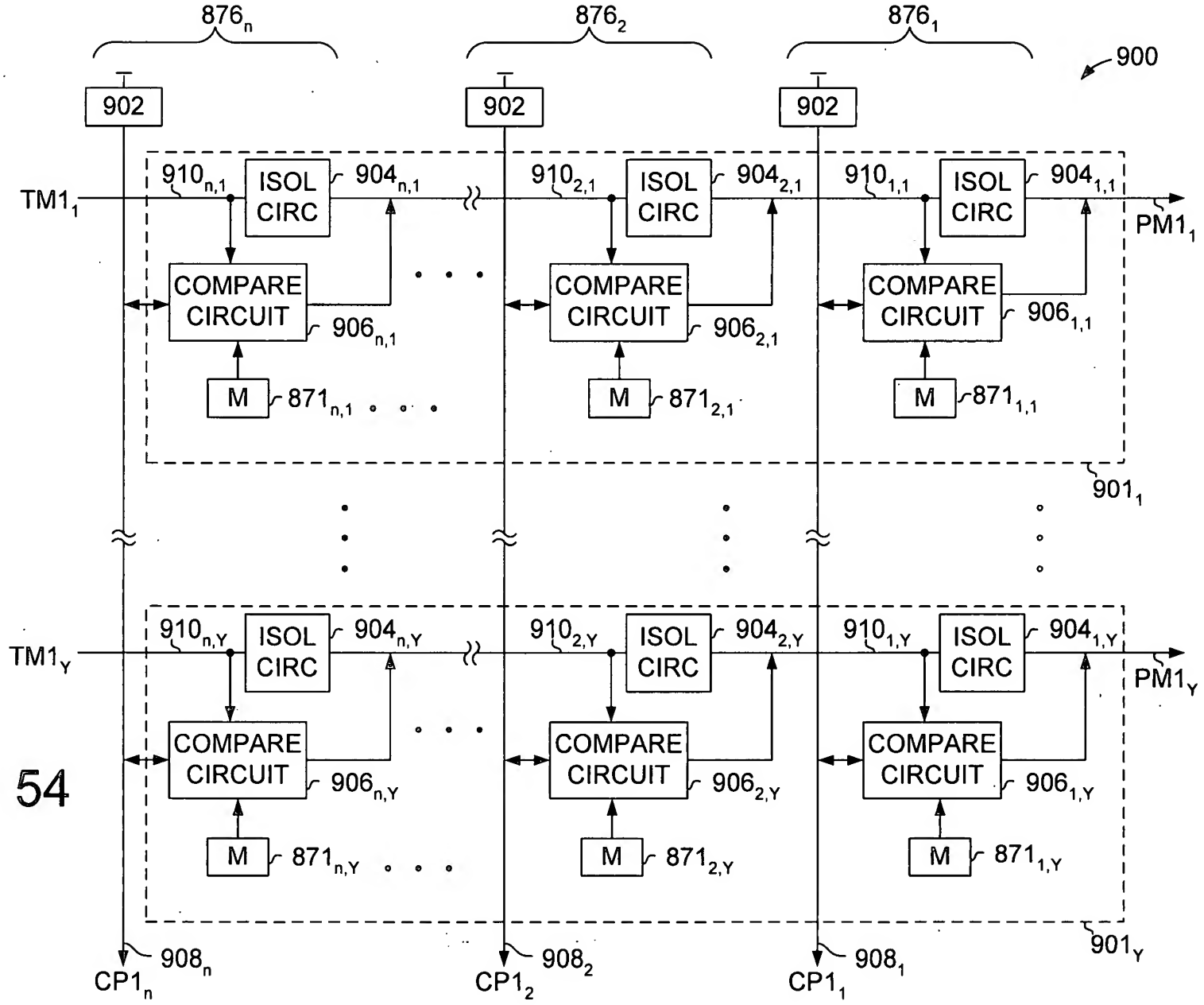

876n
876 2
876 1
900
902
902
902
910n,1
ISOL CIRC
904n,1
910 2,1
ISOL CIRC
904 2,1
910 1,1
ISOL CIRC
904 1,1
TM1 1
PM1 1
COMPARE CIRCUIT
906n,1
COMPARE CIRCUIT
906 2,1
COMPARE CIRCUIT
906 1,1
M
871n,1
M
871 2,1
M
871 1,1
901 1
910n,Y
ISOL CIRC
904n,Y
910 2,Y
ISOL CIRC
904 2,Y
910 1,Y
ISOL CIRC
904 1,Y
TM1 Y
PM1 Y
COMPARE CIRCUIT
906n,Y
COMPARE CIRCUIT
906 2,Y
COMPARE CIRCUIT
906 1,Y
M
871n,Y
M
871 2,Y
M
871 1,Y
901 Y
908n
908 2
908 1
CP1n
CP1 2
CP1 1

FIG. 54

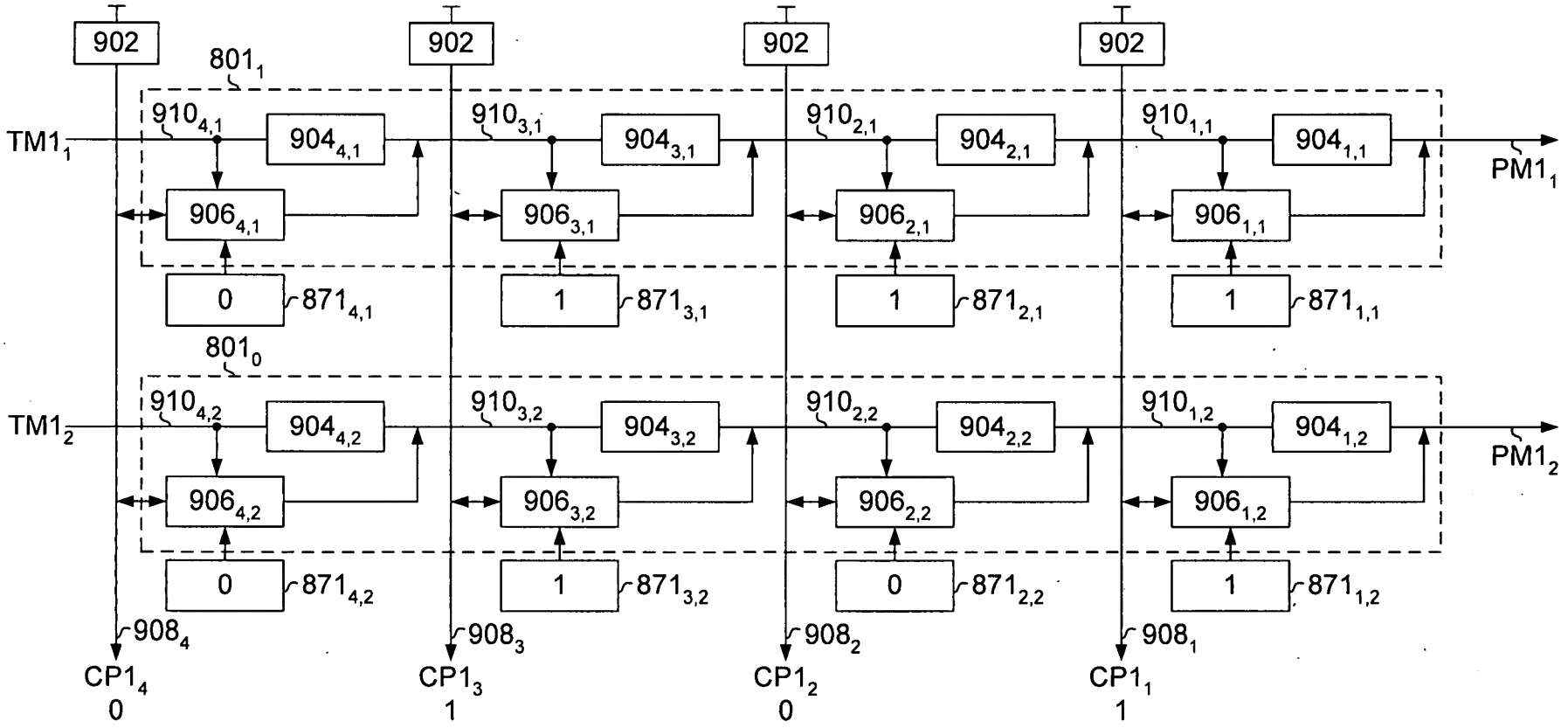
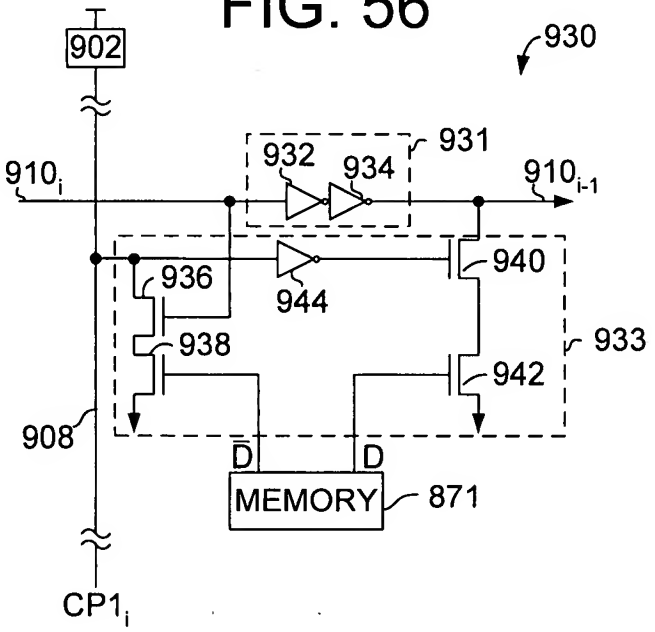

902
902
902
902
801$_1$
801$_0$
TM1$_1$
TM1$_2$
910$_{4,1}$
910$_{3,1}$
910$_{2,1}$
910$_{1,1}$
904$_{4,1}$
904$_{3,1}$
904$_{2,1}$
904$_{1,1}$
PM1$_1$
906$_{4,1}$
906$_{3,1}$
906$_{2,1}$
906$_{1,1}$
0
1
1
1
871$_{4,1}$
871$_{3,1}$
871$_{2,1}$
871$_{1,1}$
910$_{4,2}$
910$_{3,2}$
910$_{2,2}$
910$_{1,2}$
904$_{4,2}$
904$_{3,2}$
904$_{2,2}$
904$_{1,2}$
PM1$_2$
906$_{4,2}$
906$_{3,2}$
906$_{2,2}$
906$_{1,2}$
0
1
0
1
871$_{4,2}$
871$_{3,2}$
871$_{2,2}$
871$_{1,2}$
908$_4$
908$_3$
908$_2$
908$_1$
CP1$_4$
0
CP1$_3$
1
CP1$_2$
0
CP1$_1$
1

FIG. 55

FIG. 56



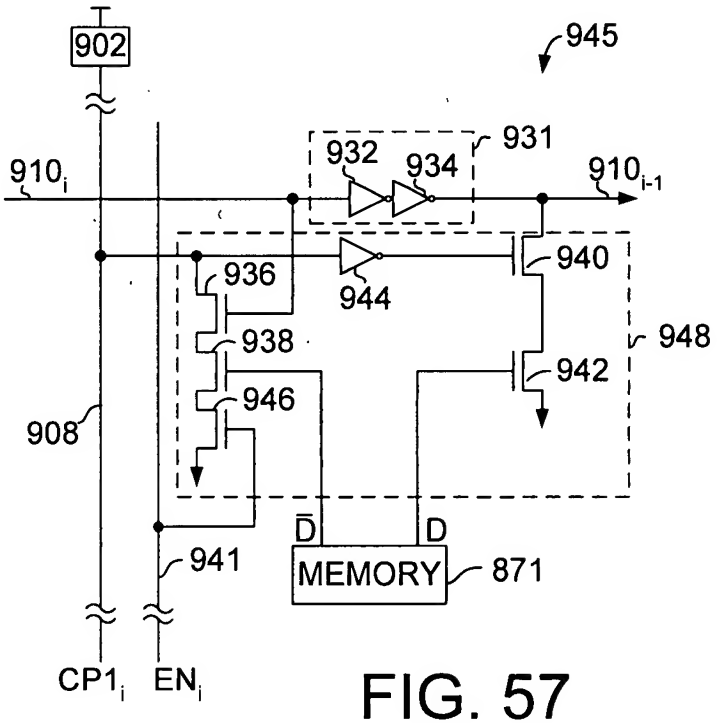


FIG. 57

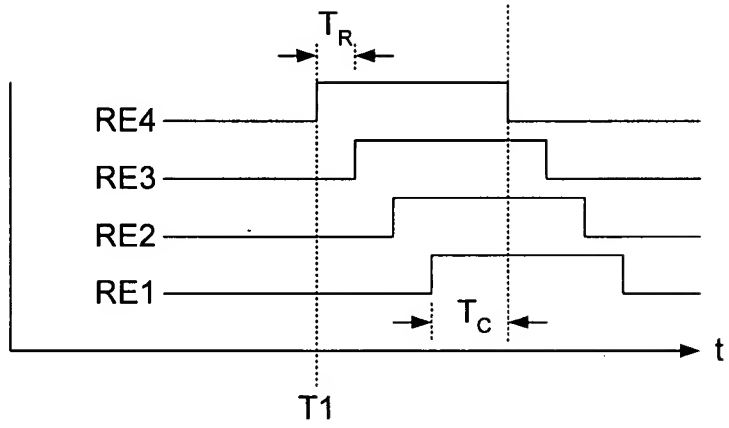


FIG. 58

FIG. 59

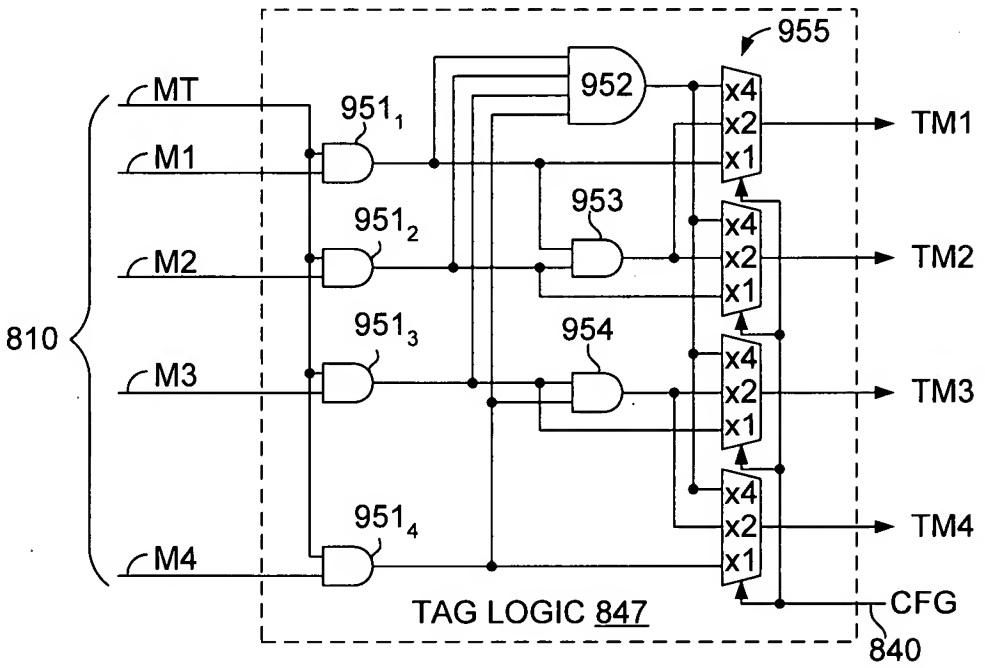
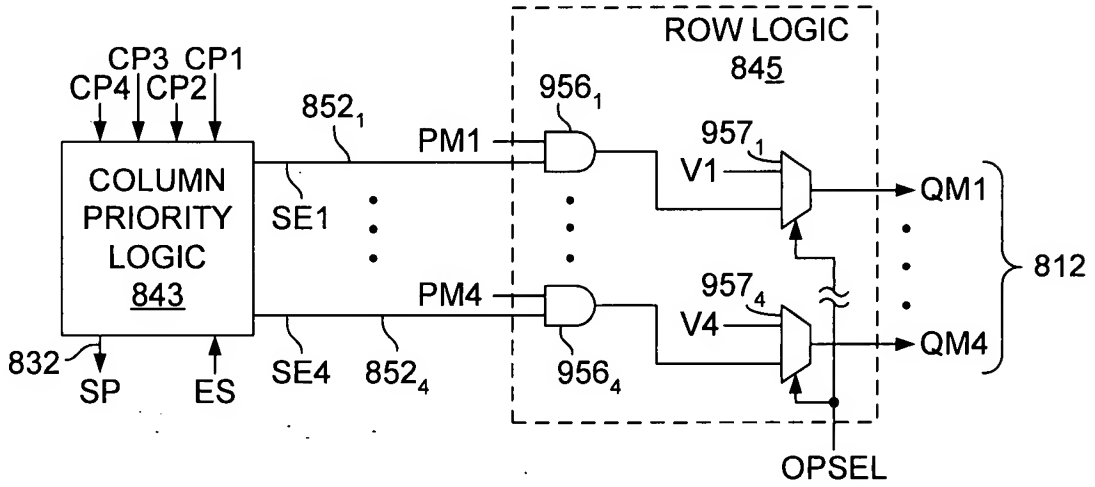

955
MT
M1
M2
M3
M4
810
951 1
951 2
951 3
951 4
952
953
954
x4
x2
x1
TM1
TM2
TM3
TM4
CFG
840
TAG LOGIC 847

FIG. 60


CP3 CP1
CP4 CP2
COLUMN
PRIORITY
LOGIC
843
832
SP
ES
852 1
SE1
SE4
852 4
PM1
PM4
ROW LOGIC
845
956 1
956 4
957 1
957 4
V1
V4
QM1
QM4
812
OPSEL

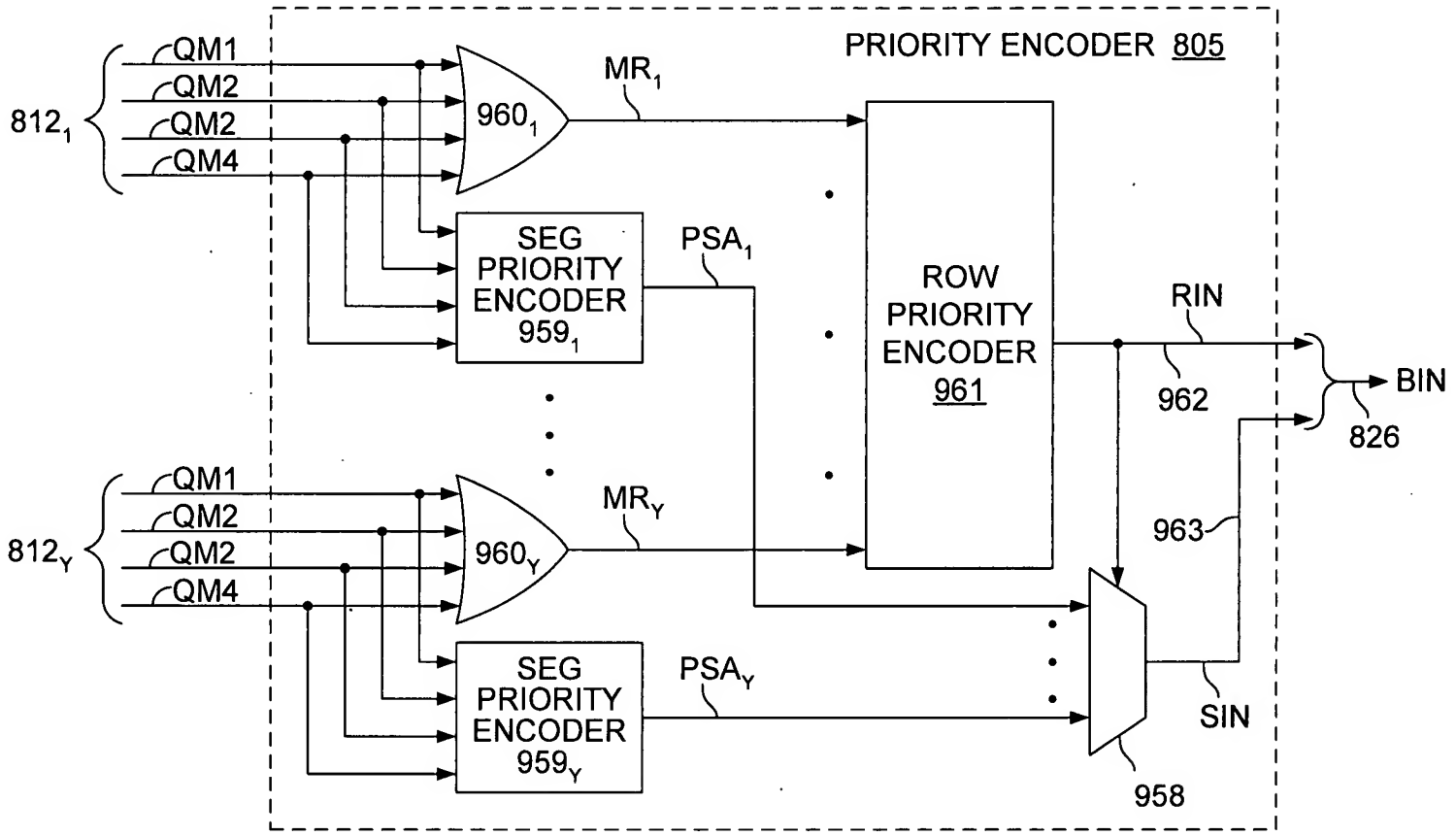

PRIORITY ENCODER 805
QM1
QM2
QM2
QM4
812$_1$
960$_1$
MR$_1$
SEG PRIORITY ENCODER 959$_1$
PSA$_1$
ROW PRIORITY ENCODER 961
RIN
962
BIN
826
QM1
QM2
QM2
QM4
812$_Y$
960$_Y$
MR$_Y$
963
SEG PRIORITY ENCODER 959$_Y$
PSA$_Y$
SIN
958

FIG. 61

FIG. 62

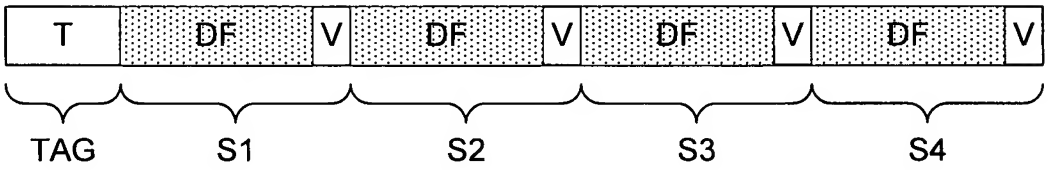


FIG. 63

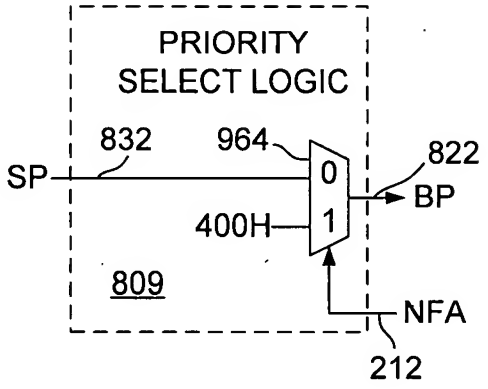


FIG. 64

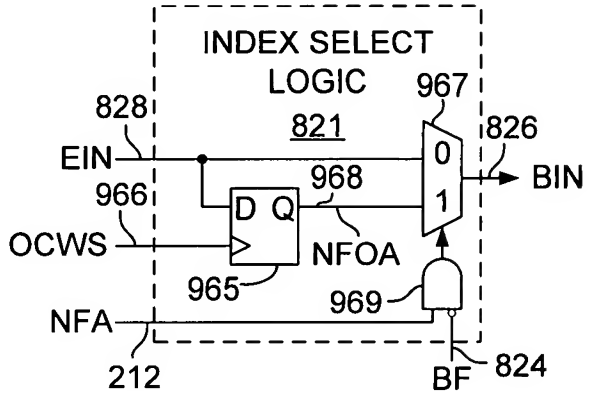
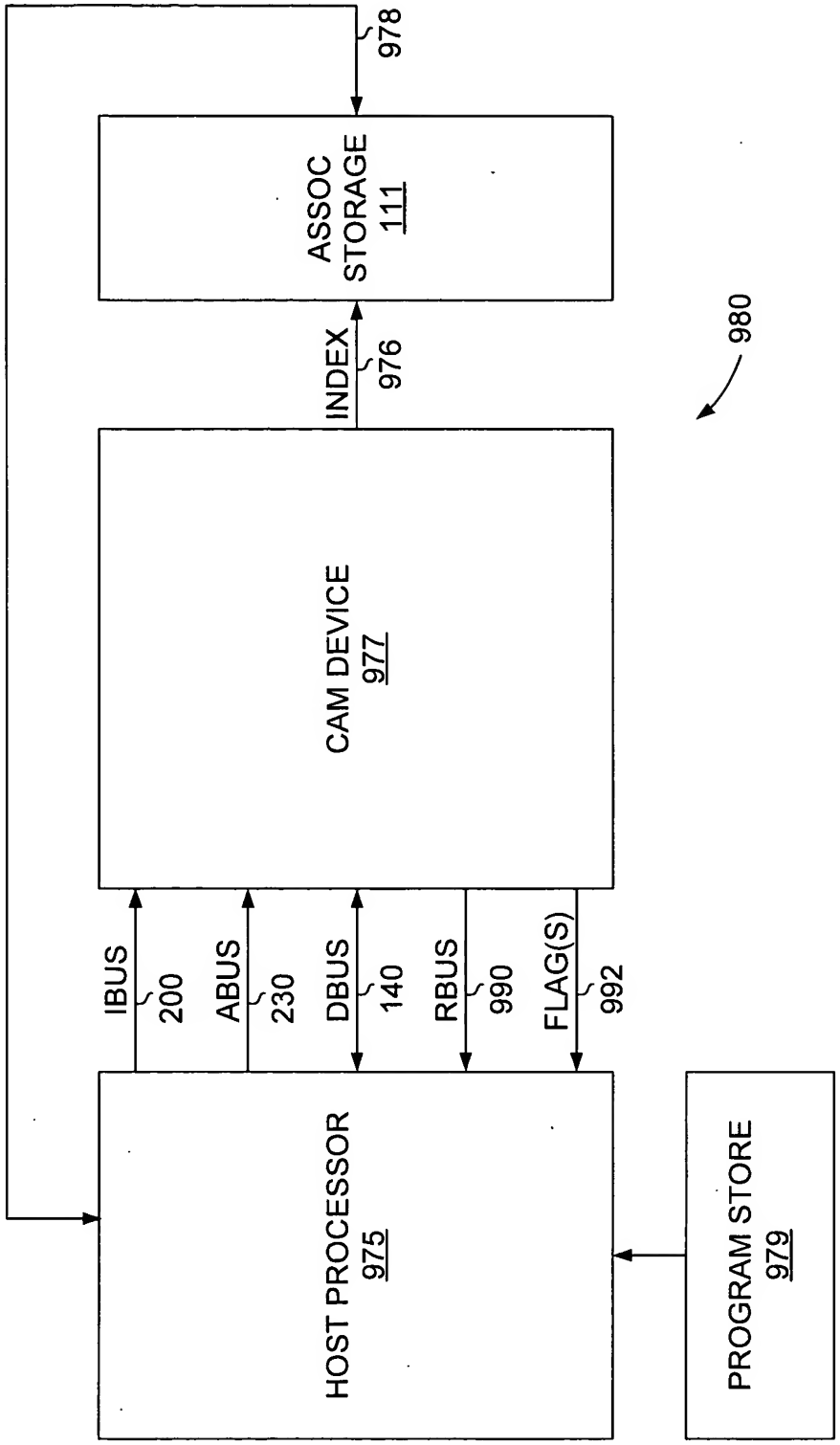


FIG. 65


978
ASSOC STORAGE 111
INDEX 976
980
CAM DEVICE 977
IBUS 200
ABUS 230
DBUS 140
RBUS 990
FLAG(S) 992
HOST PROCESSOR 975
PROGRAM STORE 979